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No. 4

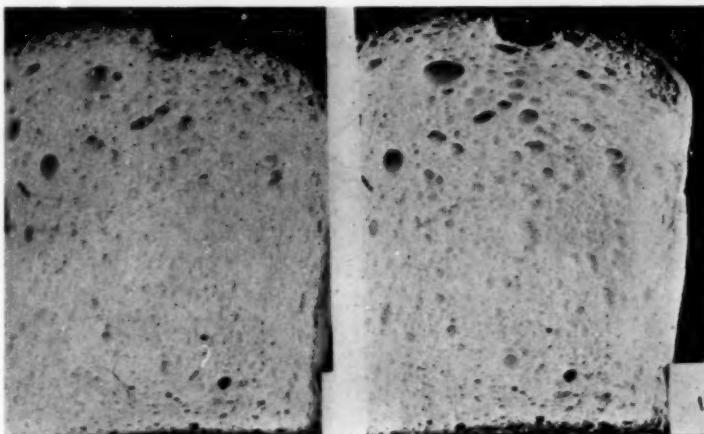
## SOME BASIC PRINCIPLES OF PHOTOGRAPHY AS APPLIED TO CEREAL WORK

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(Read at the Convention, May, 1930)

Williams has written as follows: "I have found that it is not so much the lens that is used on a camera, as it is the head on the shoulders of the user of the lens."

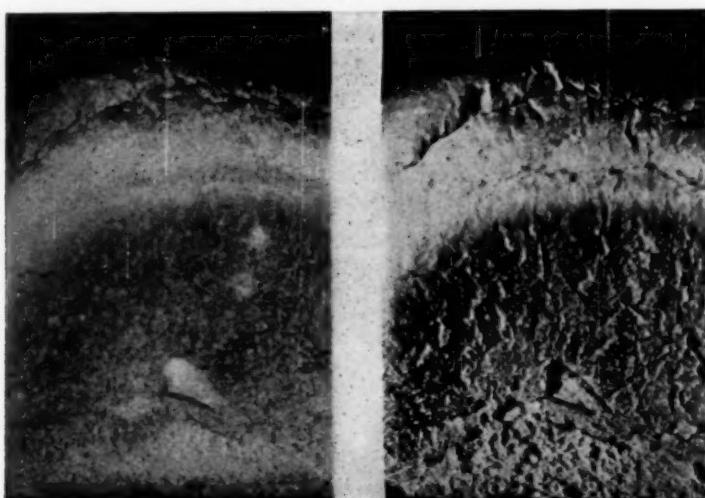


PHOTOGRAPH No. 1  
Result of Change in Angles of Illumination. Left 42 1/2°, Right 20°

Bayley says, "We can be sure that if a photographer gets some supremely fine results in the way of definition, he does so, not by the occult properties possessed by the particular lens he is using and not shared by others of its make and class, but by the care and skill with which he employs it and the favorable conditions under which he is working."

The left half of photograph No. 1 was made from a portion of a negative produced in laboratory A where photographs were made as a part of the routine work. This was done to secure the lighting conditions employed in this particular laboratory.

On the right is a similar print made of the same loaf of bread with the same camera and lens without moving either the camera or the bread. The one on the left is lacking in detail, in fact, it scarcely gives more than an outline form. So striking are the differences that the two prints would seldom be recognized as images of the same loaf.



PHOTOGRAPH No. 2  
Result of Change in Angles of Illumination. Left  $42\frac{1}{2}^{\circ}$ , Right  $20^{\circ}$ .

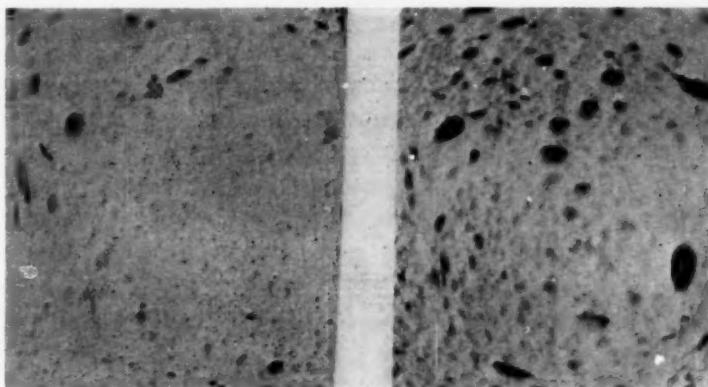
The left half of photograph No. 2 is the exterior of a loaf taken with the lighting conditions as daily used by laboratory A. On the right is the exterior of the same loaf, photographed with a more nearly correct lighting. The detail in the left is very poor, while that on the right is better.

It is the purpose of this paper to discuss and illustrate some of the materials, factors, and conditions which are so essential in securing desired results in photography of cereal products.

Contrary to the thought expressed in the first paragraph, the amateur places great faith in lenses. The finest anastigmats with an  $f$  value of 3.5 or 4.5 will in all probability be his choice. The purchase is often delayed until he has finally decided the financial strain can be stood. Lenses of  $f$  3.5,  $f$  4.5 or  $f$  5.6 have two distinct points of superiority: first, speed work; second, differential plane focusing. Neither of these two points are of interest in the photography of cereal products.

On the left in photograph No. 3 is a portion of a print made

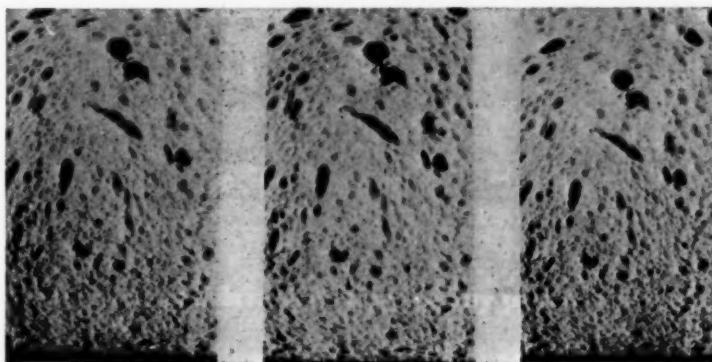
from a negative taken with a f 3.5 Carl Zeiss lens, according to the routine method used by laboratory A. On the right is given a part of a positive made without a lens. This print was made by the pin-hole method and has good definition and pleasing quality; in fact, it is superior to the one made with a lens.



PHOTOGRAPH No. 3

Photographs with the best lenses and incorrect angle of illumination compared with correct angle of illumination without a lens. Left, f 3.5 Carl Zeiss, angle illumination 42.5°. Right, angle illumination 20° without lens.

Photographs Nos. 1, 2, and 3 suggest very strongly the influence of other factors than those pertaining to lenses.



PHOTOGRAPH No. 4

Comparison of various priced lenses. Left \$3.00 lens, middle \$60.00 lens and right \$175.00 lens.

In cut No. 4 on the left is the positive made with a lens costing \$3.00, having a focal length of 5 inches. The middle print was made with a Dallenmeyer 9" focal lens costing \$60.00. The right

is the result obtained when a Bausch & Lomb 15 inch lens costing \$175.00 was employed. For definition and detail, insofar as can be told from the positive, the \$3.00 lens does equally as satisfactory work as the \$175.00 lens. If the  $f$  value used is kept constant and not lower than  $f$  16, for bread photographs, very inexpensive lenses will do excellent work.

The drawing in Figure 5 sets forth the method used in the experiments referred to in this paper. The camera was placed on a line perpendicular to the surface of the cut loaf and at such a distance that the size of the image was satisfactory. For the purpose of illumination, two projection lanterns were respectively placed where the radius of the semicircle intersected the circumference.

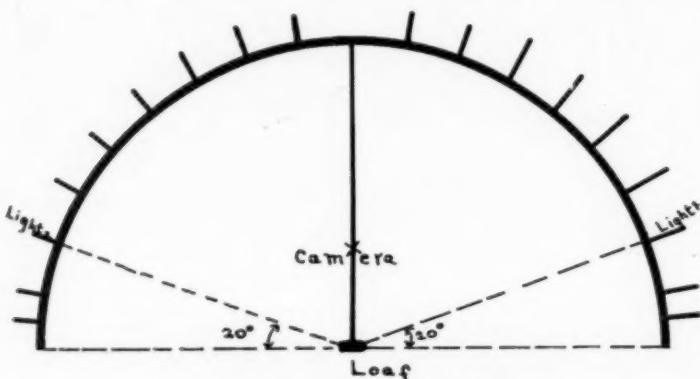
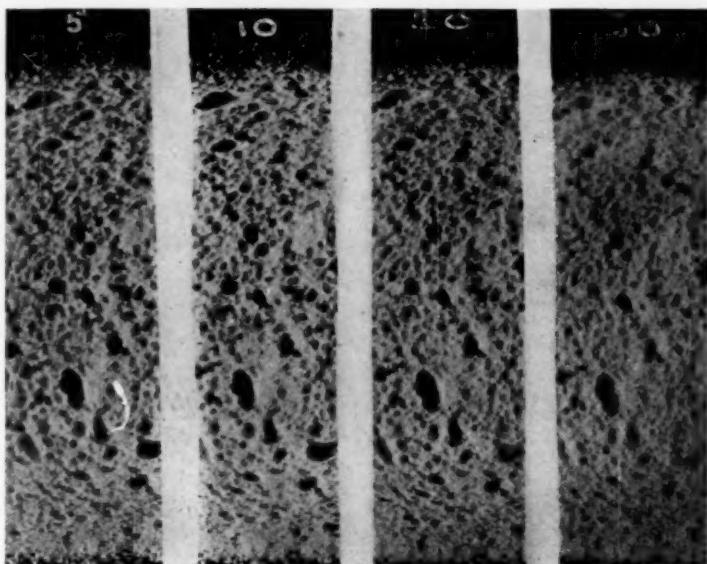


Figure 5. Diagram of Lighting Used.

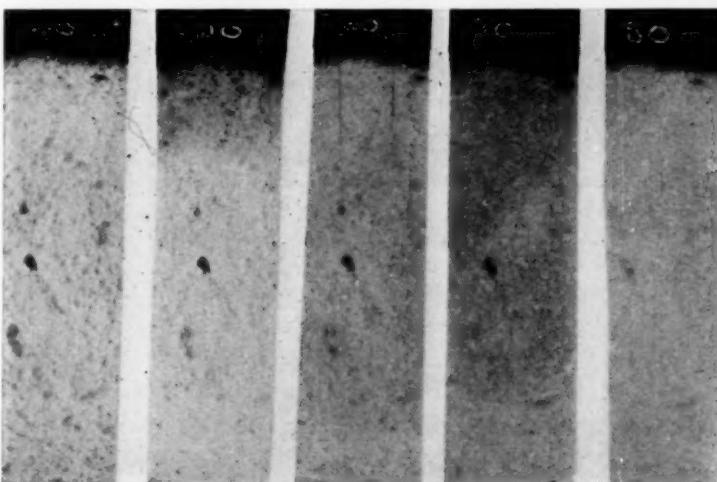
The  $20^\circ$  angles formed will be called the angles of illumination. Exposures were then made of the same loaf of bread when the angles of illumination were  $5^\circ$ ,  $10^\circ$ ,  $20^\circ$ ,  $30^\circ$ ,  $40^\circ$ ,  $50^\circ$ ,  $60^\circ$ ,  $70^\circ$ , and  $80^\circ$  respectively. Small strips from each of the negatives representing the same cross section of the loaf, have been cut and are shown in the prints in photographs Nos. 6 and 7.

The numbers appearing in white give the angle of illumination for each exposure. At  $5^\circ$  we find that the grain appears very coarse and the detail good,  $10^\circ$  gives a very slightly smaller grain appearance with excellent detail in all respects. The best results appear at  $20^\circ$ . The grain appears considerably smaller at  $30^\circ$ , while at  $40^\circ$ ,  $50^\circ$ ,  $60^\circ$  etc., the grain seems to become progressively smaller and almost entirely disappears, as the angle of illumination increases. We have much the same result as would be obtained by photographing a white sheet of paper. Proper lighting is most important in photographing any subject. The appearance in the

positive of the grain, texture, etc., depends largely upon the angle of illumination. The incorrect angle explains the failure in photo-



PHOTOGRAPH No. 6  
Results Obtained in Varying the Angles of Illumination.

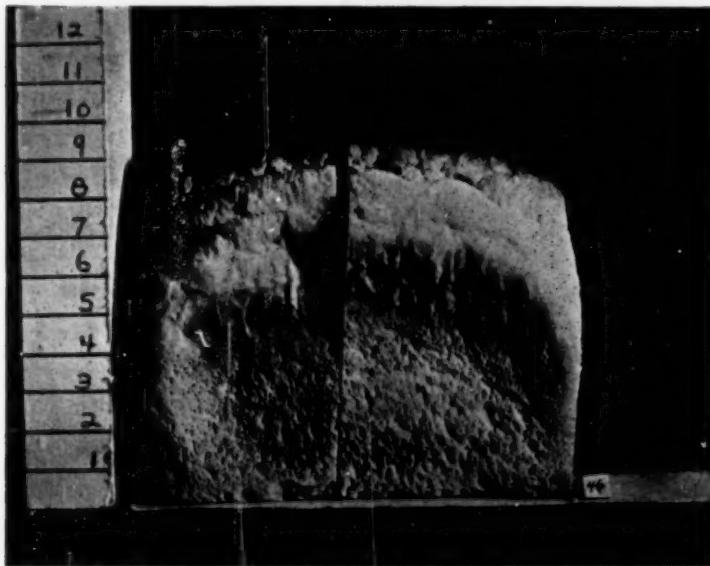


PHOTOGRAPH No. 7  
Results Obtained in Varying the Angles of Illumination (Continued).

graphs Nos. 1, 2, and 3, as the angle employed was approximately  $42.5^{\circ}$ . In Cereal Chemistry Vol. 5, page 294 is a reproduction of

the standard type J. The negative of this reproduction was made with a flat lighting. Photograph 7b employs illumination giving shadows which emphasize the minute details of the loaf. The proper perspective in cross-sections of bread can be secured by the correct use of shadows which call for definite illumination.

Dr. R. E. Lee has devised a method of spraying the cut surface of bread with china white before making an exposure. This according to Dr. Lee makes the bread appear whiter. Excellent photographs can be obtained in this manner. The contrast between the cut surface and the inner surface of the hole is increased. This



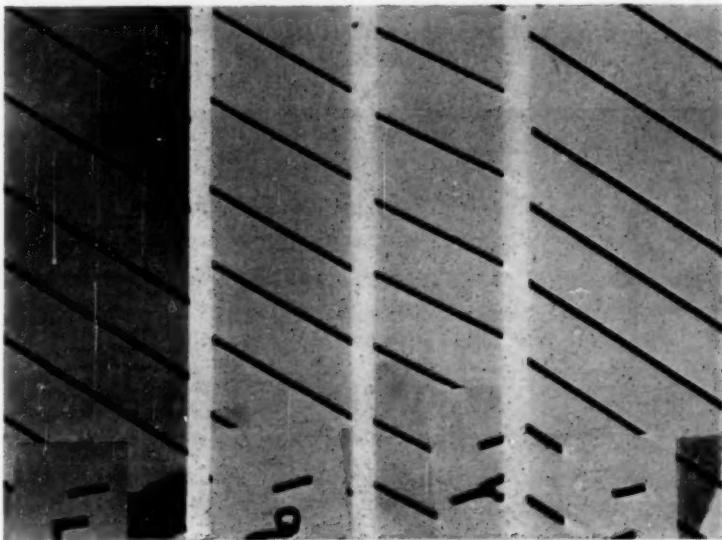
PHOTOGRAPH No. 7b  
Perspective and Detail Obtained by Use of Shadows.

method although producing good results, has two distinct disadvantages: first, the surface of the bread cannot be sprayed without destroying to some extent the minute detail, as well as whatever color tone exists in the different loaves; second, it is an additional step that can be eliminated by the proper choice of emulsions.

In cut No. 8 are the positives of four sections of negatives made of a strip of light brown paper on which lines were drawn with India ink.

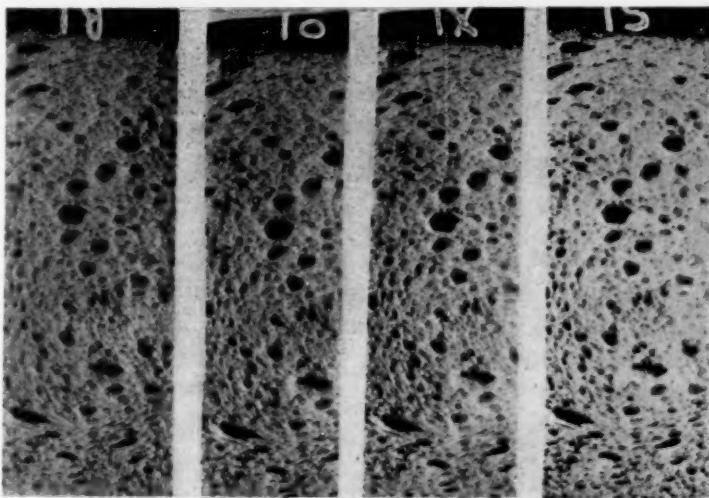
Reading from left to right, the first strip was made with a super speed portrait emulsion, the second with a par-speed por-

trait emulsion, the third with a commercial emulsion, and the last with process emulsion. Beginning with the super-speed, the con-



CUT No. 8

A comparison of different photographic emulsions. Reading from left to right, 1st Super-speed, 2nd Par-speed, 3rd Commercial, 4th Process.

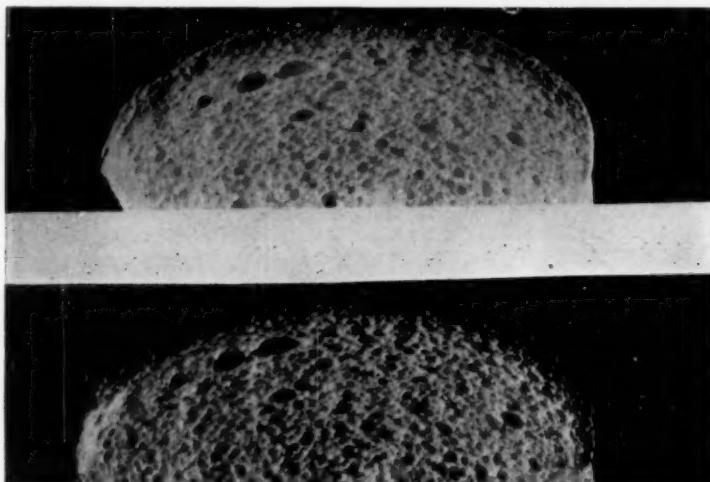


PHOTOGRAPH No. 9

Different photographic emulsions applied to bread. Reading from left to right, 1st Super-speed, 2nd Par-speed, 3rd Commercial, 4th Process.

trast increases with each succeeding type of emulsion, reaching its maximum in the process type.

Photograph No. 9 gives the application to a cross-section of bread. The emulsions are in the same order as in cut No. 8. Here we find that as the contrast is increased with each succeeding type of emulsion, the surface cut is kept white, while the holes are emphasized to a greater extent.



PHOTOGRAPH No. 10  
Comparison of Commercial and Panchromatic Emulsions.  
Upper—Panchromatic. Lower—Commercial.

The conclusion reached in regard to texture from observing the photographs depends to a great extent upon the emulsion used. The process with maximum contrast on the extreme right, appears to have a much harsher texture than the super-speed, with a minimum contrast on the extreme left. If a scientific observer desires to study grain or cell structure and not deal with the artistic, a type of emulsion having considerable contrast has no equal. The proper emulsion is almost as important as proper lighting. The utility of a camera depends to a great extent upon the availability of different types of emulsions.

Thus far, ortho- or panchromatic emulsions have not been considered. It will suffice to illustrate the latter.

In photograph No. 10, the lower part shows a section of bread photographed using a commercial type emulsion, while the upper shows the same loaf section with a commercial panchromatic emulsion using a K3 filter. The only difference is that the contrast between the crust and crumb is not so great in the case of the panchromatic. It is very questionable if this small difference is worth the additional cost and trouble involved.

Micro-photographs are easily made with almost any camera box. In regard to emulsion selection, such is very limited. The only plate available at present in this country is plate M, which is a panchromatic type and can be obtained by ordering direct from the Eastman Kodak Company. This gives excellent results as shown in the lantern slides presented which are of powdered cinnamon, cake, short patent bread and clear flour respectively.

Should it be desired to photograph in natural color, a plate of the Lumiere or Agfa color type can be used. In the lantern slide shown<sup>1</sup> reading from left to right, beginning at the top row, each succeeding doughnut was made from a formula containing an increment of  $\frac{1}{2}\%$  in sugar. The resulting crust color differences are very clearly recorded. The slide of dyed bread recently adopted by society to match tablecloths or what-not, shows the ability of the plate to record other colors. In addition, plates of this type can be used for photo-micrographic color work. Agfa Company states that it is necessary to use an apochromatic objective. The apochromat has better color correction but its field is so curved that the sharpness secured with anastigmat cannot be obtained.

### Summary

The results obtained in photographing cereal products depend to a large extent upon the technique of the operator. The angle of illumination is exceedingly important. In interpreting bread photographs, the angles of illumination must be given consideration, as the apparent size of the grain depends upon these angles. The selection of the proper emulsion for the particular type of work is almost as important as correct illumination.

### Literature Cited

- Williams, Leonard A.  
Illustrative Photography in Advertising. Frederick Stokes Co.  
Bayley, Child R.  
The Complete Photographer. Camera Craft Pub. Co.

<sup>1</sup> The slides mentioned here and in the preceding paragraph are not reproduced in this article.

## **MODIFICATION OF THE SWANSON MIXER AND ITS APPLICATION TO THE STANDARD BAKING TEST**

**W. L. HEALD**

Laboratories Service Division, Commander-Larabee Corp.

(Read at the Convention, May, 1930)

The work done by the Baking Committee last year and reported at the meeting of the American Association of Cereal Chemists, held in Kansas City, proved very strikingly the need of a mixer suitable for small doughs.

During the Convention Dr. C. O. Swanson visited our laboratory, then located in the Board of Trade building. The question was raised as to why it would not be possible to incorporate his mixer in the form of an attachment for the Hobart machine. Having an extra mixer on hand it was agreed to allow Dr. Swanson to use this machine to see what could be done toward incorporating his principle, with the understanding that if the machine proved satisfactory we would stand a certain part of the expense.

On July 31, 1929, I received a letter from Dr. Swanson saying that the mixer was ready to try out. On August 6, 1929, we received the mixer. It proved very satisfactory except for some minor changes in the bowl. These changes were made and the mixer has been in daily use in our laboratory, mixing from 20 to 50 small loaves a day, since October 19, 1929. The largest dough we can mix successfully is 200 grams.

### **Equipment**

Having a Hobart mixer equipped with the small bowl and paddle arm, which we had previously used in preference to hand mixing, it was suggested that we bake a series of loaves mixed by these two machines, varying only the mixing time.

### **Procedure**

The tentative method of the American Association of Cereal Chemists was used in every detail except that machines were used in the mixing. Four series were baked and the mixing time varied from 1 to 6 minutes at  $\frac{1}{2}$  minute intervals. Two series were baked using the Hobart machine; one on second speed and the other on high speed. Two more series were baked using the Swanson modification; one series on second speed and one on high speed. The Hobart machine has a second speed of 109 r.p.m. and a high speed of 240 r.p.m. The Swanson modification of course would have the same speed.

The flour used was a baker's flour with an analysis of 11.2% moisture, 0.45% ash and 11.10% protein. The baking was done on four consecutive nights, a series being baked each night. Four loaves were mixed and baked on each mixing time. Each dough was weighed as it was taken from the mixer before being placed in the fermenting bowl. Each loaf was weighed as it was taken from the oven. The volume was taken in cubic centimeters when the bread was sufficiently cool. An attempt was made to grade each loaf numerically. All the loaves were hand-moulded by one operator. The loaves photographed were those which in most cases came nearest the average volume.

### Data

Tables I and II show the data obtained on the loaves representing each mixing time on the Hobart machine at second and high speed respectively. Tables III and IV show the data obtained with the Swanson modification on second and high speed respectively. You will notice from the tables a variation of as much as 6.5 gms. on the doughs from the mixer. This is largely accounted for by dough sticking to the sides of the bowl. After the first series were mixed the bowl was scraped and 21 gms. of dough remained on the sides. Your attention is also called to the fact that there is considerable difference in the weight of the individual loaves. In Table I we find a variation in weight of from 123 to 140 gms., or 13.8%. The fermentation and baking loss for the average of 44 loaves, as shown in Table I, is 31.2 gms. The photographs from 1 to 11 represent this series.<sup>1</sup> From an exterior and interior point of view there is very little difference in these loaves, there being only an average maximum variation in volume of 21 cc. This undoubtedly is due to the light mixing given the dough. Unless the dough is very stiff it tends to spread around the bowl and in such a condition very little mixing action is afforded.

Table II is a tabulation of the baking data on the Hobart at high speed, varying the mixing time from 1 to 6 minutes at  $\frac{1}{2}$  minute intervals. Here we find the maximum loaf volume at  $4\frac{1}{2}$  minutes. Again we find a variation in the weight of the doughs of from 157 to 163 gms. On the weight of the loaves there is a variation of from 123 to 135 gms. or 9.7%. The fermentation and baking loss for the average of 44 loaves, as shown in Table II, was 31 gms. Again the bowl was scraped after 44 loaves had been mixed and it was found that 45 gms. remained on the sides.

<sup>1</sup> The photographs of the bread were shown at the Convention with a projection lantern; they are not included in this article.

The photographs from 12 to 22 represent this series. A maximum variation in loaf volume of 45 cc. is found with the best grain and texture at the 5 minute mixing time. From the data presented it is evident the doughs are not over developed at 6 minute mixing with the Hobart at high speed.

Table III is a tabulation of baking data on the Swanson modification at second speed, with the mixing time varied from 1 to 6 minutes at  $\frac{1}{2}$  minute intervals. The average maximum volume occurs at 1 minute with the average maximum volume for  $1\frac{1}{2}$ , 2 and  $2\frac{1}{2}$  minutes varying only a few cc. The volume curve, as shown in Fig. 1, is a declining curve, while the Hobart second speed shows only a very slight decline. The greatest variation in the weight of the doughs from the mixer is 159 to 163 gms. and there is a variation of from 123 to 134 gms. in the weight of the loaves or 8.9%. The fermentation and baking loss for the average of 43 loaves, as shown in Table III, was 31 gms. The bowl when scraped after mixing 43 loaves gave 1 gm. of dough.

The photographs from 23 to 33 represent this series. The data here shows a difference of 61 cc. in volume between the average volume for the high and low. The best grain and texture we find at the 3 minute mixing time. The 6 minute mixing time here shows a decided break down in volume, grain and texture.

Table IV is a tabulation of the baking data on the Swanson modification at high speed with the mixing time varied from 1 to 3 minutes at  $\frac{1}{2}$  minute intervals (a greater period of time proved impractical, since it was almost impossible to get the dough from the mixer). We have a maximum average volume on the 1 and  $1\frac{1}{2}$  minute mixing time with a rapid decrease in volume as the mixing time increases. The greatest variation in the weight of the doughs is 5 gms. The greatest variation in the weight of the loaves is from 125 to 135.5 gms. or 8.4%. The average fermentation and baking loss for 20 loaves is 30.8 gms. The photographs from 34 to 38 represent this series. The data shows a difference of 73 cc. between the average volume of the high and low. The best grain and texture were obtained on the  $1\frac{1}{2}$  and 2 minute mixing periods.

Figure 1 graphically represents the loaf volume plotted against the mixing time on both the Hobart and the Swanson modification at second speed.

Figure 2 graphically represents the loaf volume plotted against the mixing time on the Hobart and Swanson modification at high speed.

TABLE I  
HOBART MIXER  
Second Speed

Absorption 62%							No. 3—2 MINUTES							
No. 1—1 MINUTE							No. 2—1½ MINUTES							
Weight of Dough	Wt. of Leaf	Vol. cc.	Grain and Texture	Dough Temp.	Weight of Dough	Wt. of Leaf	Vol. cc.	Grain and Texture	Dough Temp.	Weight of Dough	Wt. of Leaf	Vol. cc.	Grain and Texture	Dough Temp.
160	123	550	99.9	82	162	128	540	99.9+	86	164	128	530	99.9	85.8
159	124	510	99.9	86	162	127	525	99.9	86	162	123	530	99.9	86
164.8	131	525	99.8	86	164	130	535	99.9	85	164	130	525	99.9	86
164	127	535	99.8	86	165.5	131	545	99.9	85	163.5	127	545	99.9+	86
Ave. 161.9	126.2	530			Ave. 163.3	129	536			Ave. 163.3	127	532		
No. 4—2½ MINUTES							No. 5—3 MINUTES							No. 6—3½ MINUTES
164.5	130	530	100	86	161	132	515	100	86	160.5	128	525	99.8	84
164.5	131	520	100	86	163	136	515	100	86	163	132	495	99.8	84
164	130	520	99.9	87	163	134	530	100	86	163	132	515	99.9	84
162	131	545	99.9	86	165	135	520	100	86	165.5	140	530	99.9	85
Ave. 163.7	130	528			Ave. 163	134	520			Ave. 163	134	518		
No. 7—4 MINUTES							No. 8—4½ MINUTES							No. 9—5 MINUTES
165	137	505	100	84	163	133	515	99.9	86	164	135	535	100	86
163	137	510	100	86	161	137	515	99.9	86	162	132	515	100	85
162	134	495	100	88	163	132	520	99.9	86	163	136	530	99.9	84
162	138	525	100	86	159	130	520	99.9	85	164	137	545	99.9	85
Ave. 163	136.5	509			Ave. 161.5	133	517			Ave. 163	135	531		
No. 10—5½ MINUTES							No. 11—6 MINUTES							
161	137	530	99.8	86	164	132	495	99.9	86					
164	140	515	99.9	86	161	133	520	99.9	85					
162.5	127	510	99.8	86	164	132	525	99.9	86					
162	133	520	99.8	86	161	133	520	99.9	86					
Ave. 162.3	134.2	519			Ave. 162.5	132.5	515							

TABLE II  
HOBART MIXER  
High Speed

No. 12—1 MINUTE						No. 13—1½ MINUTES						No. 14—2 MINUTES					
Weight of Dough	Wt. of Loaf	Vol. cc.	Grain and Texture	Dough Temp.	Weight of Dough	Wt. of Loaf	Vol. cc.	Grain and Texture	Dough Temp.	Weight of Dough	Wt. of Loaf	Vol. cc.	Grain and Texture	Dough Temp.	Weight of Dough	Wt. of Loaf	Vol. cc.
162	130	515	100—	86	162	127	555	100	86	160	130	550	100	86	159	131	545
159	131	535	100—	86	161	129	515	100	86	160	131	525	100+	87	160	133	525
160	133	500	99.8	86	162.5	129	525	100	86	158	123	525	100—	86	157	126	495
Ave.159.5	130	511			160.5	130	525	100	86	161	127	545	100—	86	Ave.161.5	128.7	532
					Ave.161.5	128.7				Ave.159.7	127.7				Ave.159	127.7	541
No. 15—2½ MINUTES						No. 16—3 MINUTES						No. 17—3½ MINUTES					
161	130	535	100	86	158	130	515	100+	86	158	131	530	100	86	160	127	540
160	127	540	100	86	160	125	530	100	85	158	134	540	100+	86	160	129	545
160	129	545	100	86	160	131	545	100+	86	161	130	530	100	86	163	130	545
163	130	550	100	86	163	130	545	100+	86	161	131	540	100—	86	Ave.161	129	543
					Ave.160.2	129				Ave.159.5	131.5				Ave.160.2	129.3	534
No. 18—4 MINUTES						No. 19—4½ MINUTES						No. 20—5 MINUTES					
159	129	520	100	88	160	125	555	100—	88	159	131.5	520	100+	86	158	133	525
158	133	520	100+	86	159	128.5	555	100	86	160	134	525	100+	86	158	130	525
158	130	525	100+	86	161	133	565	100	86	160	128	520	100+	85	161	134	531
161	134	545	100	86	161	131	550	100	86	162	132	550	100+	86	Ave.159.2	131.5	528
					Ave.160.2	129.3				Ave.160.2	131.3				Ave.159.7	133	544
No. 21—5½ MINUTES						No. 22—6 MINUTES						No. 23—7½ MINUTES					
159	128	525	100+	86	159	139	575	99.9	86	159	135	525	99.9	86	159	130	546
159	130	525	100+	86	159	135	540	99.9	85	162	129	540	99.9	85	160	131.5	555
160	131.5	540	100	85	162	129	540	99.9	85	159	129	535	100	85	160	131.5	546
					Ave.159.5	130.2				Ave.159.7	133				Ave.159	130.2	536

TABLE III  
SWANSON MODIFICATION

Absorption 62%	Second Speed														
	No. 23—1 MINUTE					No. 24—1½ MINUTES					No. 25—2 MINUTES				
	Weight of Wt. of Dough Dough	Wt. of Vol. Loaf	Grain and Texture cc.	Dough Temp.	Weight of Dough	Wt. of Vol. Loaf cc.	Grain and Texture Temp.	Dough Temp.	Weight of Dough	Wt. of Vol. Loaf cc.	Grain and Texture Temp.	Dough Temp.	Weight of Dough	Wt. of Vol. Loaf cc.	Grain and Texture Temp.
Ave.162.5 130.2 551	128	560	99.9	86	162	125	545	99.9	86	162.5	132	540	100	86	
163 129 555	129	555	99.9	86	162	128	525	99.9	86	162	132	545	100	86	
162.5 134 530	130	560	99.9	86	162	129	550	99.9	86	161	130	540	100	86	
Ave.162.5 130.2 551					Ave.162	127.5	535			Ave.161.6	131	538			
	No. 26—2½ MINUTES					No. 27—3 MINUTES					No. 28—3½ MINUTES				
164 132 520 100	132	520	100	86	159	129	495	100+	86	159	125	520	100	86	
163 134 540 100+	134	540	100+	86	159	134	515	100+	86	160	131	495	100	86	
162 132 535 100	132	535	100	86	160	132	505	100+	86	160	132	505	100	86	
164 130 545 100	130	545	100	86	160	129	535	100+	86	160	133	495	100+	86	
Ave.163.2 132 534					Ave.159.5 131	512				Ave.159.8 130.2	503				
	No. 29—4 MINUTES					No. 30—4½ MINUTES					No. 31—5 MINUTES				
158 128 520 100—	128	520	100—	86	159	129	505	99.9	86	160	129	495	99.9	87	
160 128 510 100—	128	510	100—	86	160	129	505	99.9	86	159	127	490	99.9	87	
160 127 520 100—	127	520	100—	86	159	123	495	99.9	86	159	129	500	99.9	87	
159 124 515 100—	124	515	100—	86	158.5	125	490	99.9	86	159	Lost	.....	.....	87	
Ave.159.2 127 513					Ave.159	126.5	498			Ave.159.2	128.3	495			
	No. 32—5½ MINUTES					No. 31—6 MINUTES					No. 33—7 MINUTES				
159 123 495 99.9	123	495	99.9	87	160	127	485	99.8	89.6						
159 125 485 99.9	125	485	99.9	87	159	131.5	495	99.8	88.7						
159 129 500 99.8	129	500	99.8	86	160	123	490	99.8	86						
160 128 505 99.8	128	505	99.8	87	159	123	490	99.9	88						
Ave.159.2 126.7 496					Ave.159.5 126.1					Ave.159.2	128.3	495			

TABLE IV  
SWANSON MODIFICATION

Absorption 63%		No. 34—1 MINUTE				No. 35—1½ MINUTES				No. 36—2 MINUTES			
		Wt. of Dough	Wt. of Loaf	Vol. cc.	Grain and Texture	Wt. of Dough	Wt. of Loaf	Vol. cc.	Grain and Texture	Wt. of Dough	Wt. of Loaf	Vol. cc.	Grain and Texture
162	129.5	560	100—	86		160	125	565	100	86	160	130	540
161	129	530	100—	86		161	131.5	570	100	86	160	130	570
161	135.5	585	100—	86		162	131	575	100	86	160	130	550
161	132.5	595	100—	86		162	128	560	100	86	160	133	565
Ave. 161.3	131.3	568			Ave. 161.3	128.9	568			Ave. 160	130.8	556	
No. 37—2½ MINUTES		No. 38—3 MINUTES				No. 39—4 MINUTES				No. 40—5 MINUTES			
160	126.5	520	100—	87		157	125	475	99.9	87.7	160	129	525
161	129	525	100—	87		160	133	500	99.9	87.8	161	132	525
160	132	525	100—	86		161	132	495	99.9	87.8	160	133.5	490
160	133.5	490	100—	86		161	128.5	510	99.9	87.8	160	130.3	515
Ave. 160.3	130.3	515			Ave. 159.8	129.6	495						

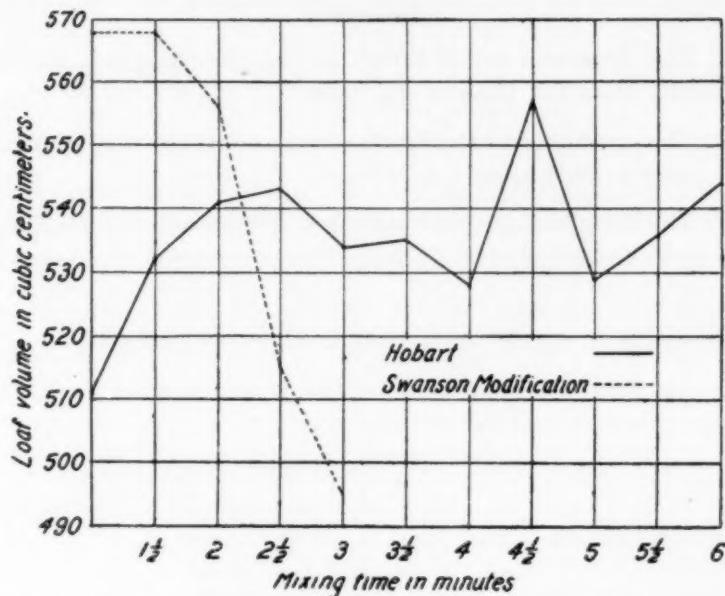


Fig. 1. Effect of variation in mixing time upon loaf volume. Both mixers operated at second speed.

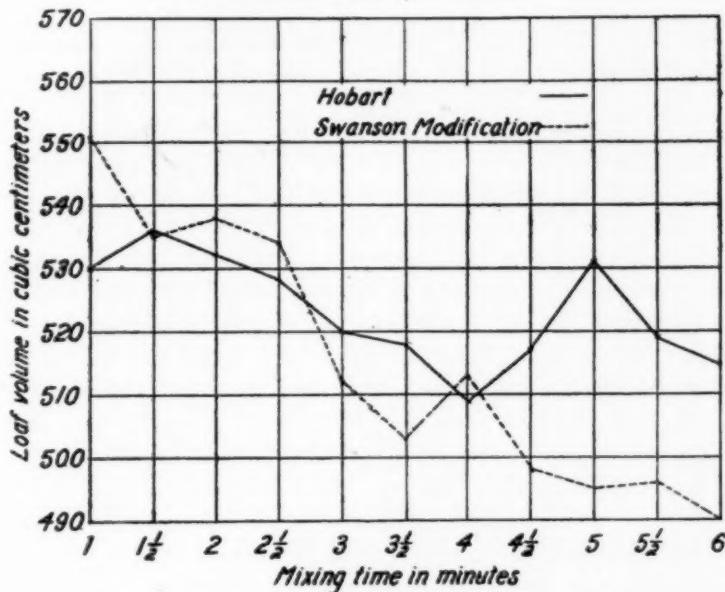


Fig. 2. Effect of variation in mixing time upon loaf volume. Both mixers operated at high speed.

**Summary**

1. The Swanson modification mixes the doughs much more thoroughly than the Hobart machine.
2. The Swanson modification incorporates the ingredients much more rapidly than the Hobart.
3. The dough sticking to the sides of the Swanson modification is practically negligible: only 1 gm. for a series of 43 doughs.
4. When high speed is used with the Swanson modification the dough begins to break down after 2 minutes of mixing.
5. Too long a mixing time on the Swanson modification tends to raise the temperature of the dough.
6. There seems to be no correlation between the loaves with the greatest weight of dough and loaf volume. Variation in loaf volume within two mixing series is probably due more to operation in molding and oven heat. This also points to the need of a small molder suitable for the 100 gm. dough in order to eliminate error and make the test bake more reliable.

**ACKNOWLEDGMENT**

The author is greatly indebted to Mr. Guy H. Foley and Mr. Joe Stoklas, who did all the baking represented in this paper.

## AN AUTOMATIC PROOFING DEVICE FOR BREAD DOUGHS

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(Read at the Convention, May, 1930)

The importance of automatic control in the proofing of bread doughs, and a device for this purpose, has been adequately described by Harrel,<sup>1</sup> and a number of reasons advanced for the adoption of such a technique, chief among these being (a) more uniform proofing, (b) removal of the hazard of overproofing, and (c) elimination of variations in the results of the baking test, due to uncontrolled proofing.

It is generally believed that the later stages of the proofing period exert a marked influence upon the quality of the final loaf, also that during this period dough characteristics are more easily discerned than at any other time in the baking. It is the author's opinion that proofing is one of the most important factors in the baking test, and it is evident that any mechanical device which will bring about more satisfactory control will insure much greater uniformity in the final results. The apparatus described by Harrel is a distinct advance, and offers a method of overcoming the difficulties referred to above. However, it appeared desirable to design if possible a similar but less complicated device which would be, at the same time, automatic and equally efficient.

The proofing device here described is easily constructed, simple in operation, and automatic in action, and has been employed with marked success for more than two years in the Laboratory of the Board of Grain Commissioners, Winnipeg. By its application, it is believed that the variations in the baking test which we believe should be attributed to uncontrolled proofing may be very largely eliminated, and that when the laboratory baked loaf approaches that of the commercial bakeshop in size and general characteristics, little difficulty will be experienced in obtaining a number of loaves from the same flour in which the maximum difference in loaf volume will be much in excess of three per cent. This we maintain to be true, regardless of whether one and the same operator bakes a number of loaves from the same flour at one time, or whether the same operator bakes a second series of loaves from the same flour at a different time, or whether a second operator bakes a series of loaves from this flour on another day.

<sup>1</sup> Harrel, C. G., "An Automatic Proof Box." *Cereal Chem.*, 4: 278-282 (1927).

### Description of Apparatus

In Fig. 1 are shown both the elevation and plan. The letter A denotes a bar, 6 mm. x 6 mm., and approximately 180 cm. in length, constructed from aluminum or any other suitable non-rusting metal.

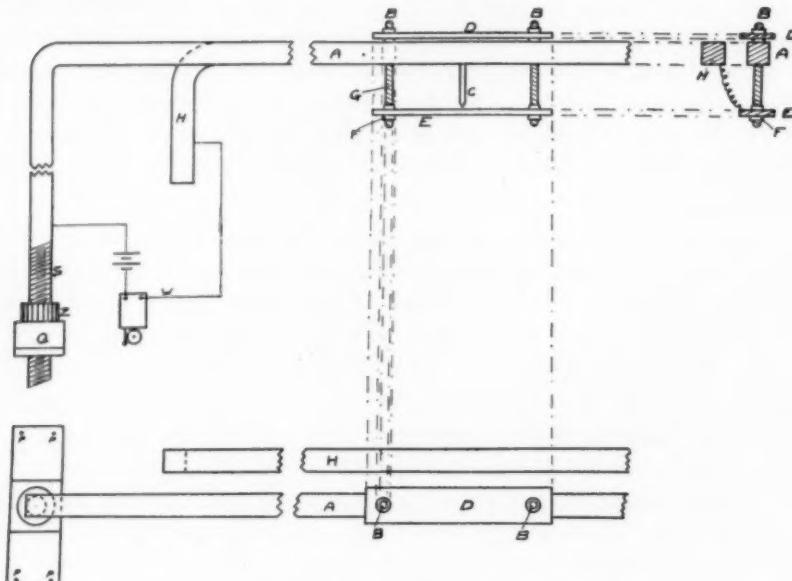


Fig. 1. Elevation and Plan Views of Proofing Device.

The length of the bar depends upon the number of doughs to be proofed, and the dimensions of the proofing chamber. In commercial bake shop practice, where only a control loaf would be necessary, the length of this bar would be relatively short, little more than the width of the baking pan. At intervals of 130 mm., holes 1 to 2 mm. in diameter are bored into the bar, and in these brass contact pins, 13 mm. in length, are tightly inserted, allowing 10 mm. of the pin to extend below the lower surface of the bar. At points 20 mm. on either side of each contact pin, holes are drilled of sufficient bore to permit free perpendicular movement of small wooden pins, 2 mm. in diameter and 28 mm. in length. These pins, which are arranged equidistant from the contact pin C, are indicated in Fig. 1 by the letters B and B<sub>1</sub>. A small plate, 4 cm. in length, 1 cm. in width, and 1 mm. thick, constructed from aluminum, is attached to the ends of the wooden carrying pins by means of small pieces of rubber tubing F, which are inserted at the junction of the pins with the plate, the joint being made secure with

DeKhotinsky cement. The distance between the upper surface of the balance plate E and the lower tip of the contact pin C should not exceed 1 mm. A supporting plate D of the same dimensions, and constructed in exactly the same manner as the balance plate, is attached to the upper ends of the wooden pins B and B<sub>1</sub>, rubber tubing and cement being also used for the joints as above. This second plate serves to make the balance plate and supporting pins more rigid.

Figure 1 also shows one end of the supporting bar A, and a second bar H, which is similar to bar A in dimensions and construction. It acts as a return circuit, strengthens the apparatus, and makes it more rigid. The two bars are separated by means of small pieces of cork, which also serve as insulating material. The bars are joined to each other by means of adhesive tape. A series of small holes, each 1 mm. in diameter, are drilled in bar H, one hole opposite each set of wooden supporting pins.

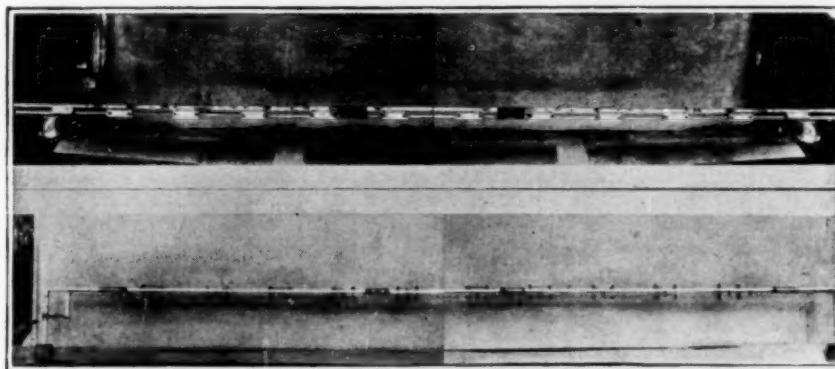


Fig. 2. Views of the Proofing Device with Contact Points for Ten Doughs.

The letter Q denotes the supporting base of the apparatus, and P indicates where screws are inserted for attaching the device to the shelf in the proofing chamber. Z indicates an adjustment screw which operates on thread S, and is so constructed that the screw end of the bar is permitted to pass through an opening in the supporting base when it is necessary to raise or lower the supporting bar. This arrangement permits the balance plate to be adjusted to any desired height above the baking pan, depending upon the type of loaf required, and the size of the dough employed. If desired, additional supporting rods may be placed at suitable distances along the main bar, but each supporting rod must be supplied with adjusting screws similar to those situated at either end of the main bar.

To complete the electrical circuit, a small piece of exceedingly fine flexible wire is attached to one corner of the balance plate, and from this point the wire is affixed to bar H through the small hole drilled opposite the wooden supporting pin. A copper wire, W, is attached to one end of bar H, and from this point terminates at an electric bell situated outside the proofing chamber. A second wire is carried from the base of bar A and attached to the other terminal of the electric bell, thus completing the circuit. Three dry cells are sufficient to operate this device satisfactorily. Fig. 2 shows two views of the proofing device with contact points for ten doughs. The device is installed in the proofing chamber on the shelf provided for the pans of dough; the base is fixed to this shelf, and



Fig. 3. A Dough about to Make Contact with the Balance Plate.

the balance plates adjusted to the desired height by means of adjusting screws. Rubber stoppers may be conveniently substituted in place of adjusting screws with the supporting arms suitably fixed in holes bored in the rubber stoppers, and adjustment may be made by raising or lowering the ends of the supporting bar through the holes in the stoppers. The correct height at which the balance plate should be placed over the center of the panned dough must be determined by making a trial baking.

#### Operation of the Proofing Device

When the fermentation is completed, the dough is moulded, placed in the pan, and transferred to the proofing chamber in such a manner that the balance plate of one of the contacts is directly over the centre of the baking pan, and rests in a position parallel to the width of the baking pan. When the surface of the risen

dough comes in contact with the lower surface of the balance plate, this is raised without resistance until the upper surface comes in contact with the base of the contact pin. The electrical circuit is then closed, and the bell indicates that the proof period is completed. Figure 3 shows one of the doughs about to make contact with the balance plate, and thereby close the circuit. The supporting bars of the device are sufficiently flexible to permit their being easily raised, so that the lower surface of the aluminum balance plate is freed from the surface of the dough, and the pan may be removed from the cabinet without difficulty.

The arrangement of the device in the proofing chamber with a number of pans suitably arranged, is shown in Fig. 4.

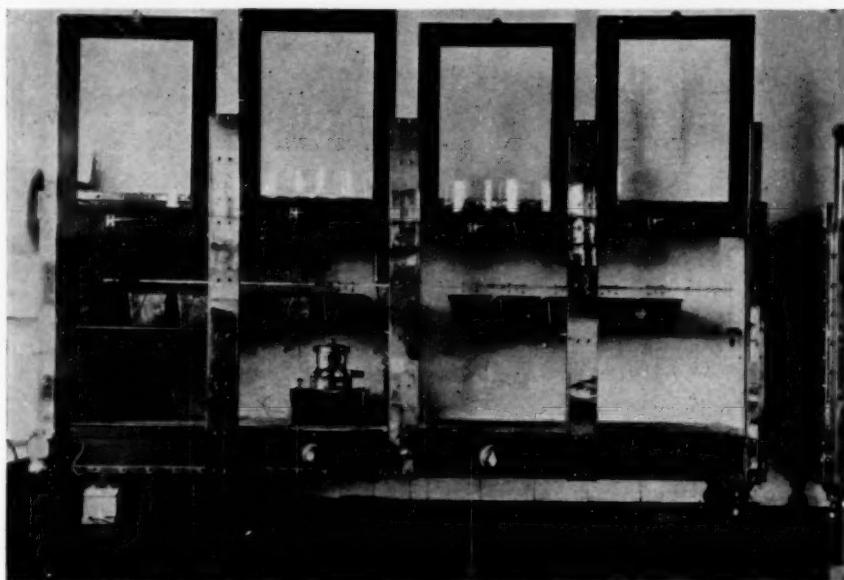


Fig. 4. Arrangement of Device in Proofing Chamber.

#### **Application of Proofing Device**

To illustrate the value of automatic control in the proofing of doughs, three series of loaves were baked from a commercially milled second patent flour. These series were as follows:

1. Eight loaves baked by one and the same operator from the same sample of flour.
2. Eight loaves baked by one and the same operator from the same sample of flour on another day.
3. Eight loaves baked by a second operator from the same sample of flour on a different day.

A brief description of the baking method follows: Using a straight dough method, 360 grams of flour, 11 grams of sugar, 11 grams of yeast, 7 grams of shortening, 7 grams of salt, 2 grams of malt-flour and 1 gram of Arkady<sup>2</sup> were mixed in a twin arm Hobart mixer, with sufficient distilled water to make a dough of the proper consistency. The fermentation time was two hours and ten minutes, with two punches—one sixty minutes after mixing, a second after another forty minutes—and after an additional thirty



Fig. 5. Series of Loaves Baked at the Same Time by One and the Same Operator from the Same Sample of Flour.

**Loaf Volumes, cc.**

Upper Row, left to right:	2935—2880—2920—2915
Lower Row, left to right:	2925—2910—2900—2850

minutes, the dough moulded by machine. All doughs were proofed in humidified air to the same height, with the aid of the proofing device, and allowed to remain in the oven at a temperature of 450° F. until baked. A very small but constant flow of steam was introduced into the oven during the whole of the baking. The loaves were measured two hours after removing them from the oven by means of the well known hour-glass principle measuring device.

Figure 5 shows a series of loaves baked at the same time by one and the same operator, from the same sample of flour.

<sup>2</sup> Arkady: An improver commonly used in commercial bake shop practice.

It will be observed that the maximum loaf volume is 2935 cc., the minimum 2850 cc., and the average 2904 cc. It should be particularly noted that the loaf volumes are unusually large, and according to all our experience, variations in volume would have been even less had a weaker flour been used.

Table I shows the loaf volumes of three series of loaves baked from the same sample of flour.

TABLE I

THREE SERIES OF LOAVES BAKED FROM THE SAME SAMPLE OF FLOUR (LABORATORY NO. F 115) BY  
(1) THE SAME OPERATOR ON TWO DIFFERENT DAYS, AND (2) A SECOND OPERATOR ON ANOTHER DAY

Operator Date of Baking	Series A No. 1 March 20	Series B No. 1 April 2	Series C No. 2 April 13
Reference No.	Loaf Vol. cc.	Loaf Vol. cc.	Loaf Vol. cc.
1	2935	2900	2880
2	2880	2905	2835
3	2920	2905	2895
4	2915	2895	2800
5	2925	2905	2870
6	2910	2890	2890
7	2900	2910	2890
8	2850	2845	2820
Average loaf Volume	2904	2894	2860
Maximum Loaf Volume	2935	2910	2895
Minimum Loaf Volume	2850	2845	2800
Maximum Variation	2.98%	2.29%	3.39%
Maximum Variation from Average	1.86%	1.69%	2.10%

Average Loaf Volume from Series A, B and C 2886 cc.

Maximum Loaf Volume from Series A, B and C 2935 cc.

Minimum Loaf Volume from Series A, B and C 2800 cc.

The absorption of all flours was 61.5%, the general appearance and texture practically identical in all loaves.

In the first series, A, the loaves were baked at one time by one and the same operator, in series B by the same operator on a different day, and in series C by a second operator on another day.

From a consideration of the results, it will be seen that in the first series the maximum variation in loaf volume was 2.98%, and the maximum variation from the average 1.86%. In the second series, the maximum variation was 2.29%, and the maximum variation from the average 1.69%, while in the third series, the maximum variation was 3.39%, and the maximum variation from the average 2.10%. It is of interest to note that the average loaf volume from the three series was 2886 cc., and that 70 per cent of the loaves were within  $\pm 1\%$  of this average volume.

From these series of tests, the following conclusions were drawn:

1. When a series of loaves is baked by an experienced operator either on the same day or on different days, the maximum difference in individual loaf volumes should not exceed 3%, and the maximum variation from the average should not exceed 2%.

2. When a series of loaves is baked from the same flour by a second operator on a different day, the maximum difference in

TABLE II  
SAMPLE NO. F. 1.

Date of Baking	Loaf Volume cc.	Date of Baking	Loaf Volume cc.
1929		1929	
April		November	
8th	2650	27th	2670
10th	2620	December	
July		6th	2680
30th	2640	11th	2650
August		13th	2680
6th	2670	17th	2650
8th	2645	27th	2645
12th	2620	1930	
14th	2615	January	
16th	2675	8th	2675
19th	2670	23rd	2680
23rd	2655	February	
September		4th	2660
13th	2665	12th	2650
16th	2670	25th	2650
21st	2660	27th	2655
25th	2680	March	
October		3rd	2650
7th	2670	5th	2655
17th	2660	7th	2700
		11th	2690
1. Average Loaf Volume	2660		
2. Maximum Loaf Volume	2700		
3. Minimum Loaf Volume	2615		
4. Maximum Variation	3.25%		
5. Maximum Variation from the Average	1.69%		
6. Variation Within $\pm 1\%$ of Average	84.4%		

loaf volume should not exceed 3.5%, and the maximum difference from the average should not exceed 2.5%.

3. When a series of loaves is baked by one or more operators from the same flour on the same or on different days, the maximum difference in loaf volume should not exceed 5%, and the maximum difference from the average should not exceed 3%.

Table II illustrates the uniformity in loaf volume obtained when a stable laboratory flour is baked at intervals over a considerable period of time, according to the method described above.

These results were not selected, but were taken in the order in which the particular sample was baked.

It should be particularly noted that in 84.4% of the cases, the loaf volume was within  $\pm 1\%$  of that of the average. From these data it was concluded that when a stable laboratory flour is baked at intervals over a considerable period of time by the same operator, the maximum difference in loaf volume should be less than 3.5%, and the maximum difference from the average should not exceed 2%.

### **Summary**

A proofing device for bread doughs has been designed which is simple in construction, automatic in action, and efficient in operation. By its application it is believed that many variations in baking results, due to uncontrolled proofing, have been completely eliminated. It has been demonstrated that when doughs are machine mixed and moulded, and proofed to height by means of this device, that the maximum difference in loaf volume in a series of loaves baked from the same flour is approximately 3%. This was found to be the case regardless of whether the loaves are baked by the same or by different operators, and on the same or on different days, also, when a series of loaves from the same flour was baked on different days by two different operators, the maximum difference in loaf volume was not greater than 5%, and the maximum difference from the average was not greater than 3%. When a standard flour was baked by the same operator at various intervals, extending over a period of nearly one year, the maximum difference in loaf volume was not more than 3.5% and the maximum difference from the average was not more than 2%. The author is of the opinion that it would be distinctly advantageous to make this device an essential part of the equipment for carrying out the baking test.

### **Author's Note**

The author wishes to thank Mr. W. J. Eva for his assistance in the construction of the proofing device, and Mr. M. H. Fisher for his aid in the baking, and the preparation of the photographs.

## A SIMPLE APPARATUS FOR MEASURING THE COMPRESSIBILITY OF BAKED PRODUCTS

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(Read at the Convention, May, 1930)

Bread, cake and some other baked products are compressible when fresh, but as they become stale this compressibility is greatly diminished.

Certain theories have been advanced as to the cause of staleness, and studies have been made with a view to its prevention. In order to study this subject, it is necessary to have some way of measuring the degree of staleness, or in other words to indicate in some manner that certain physical or chemical changes take place during storage.

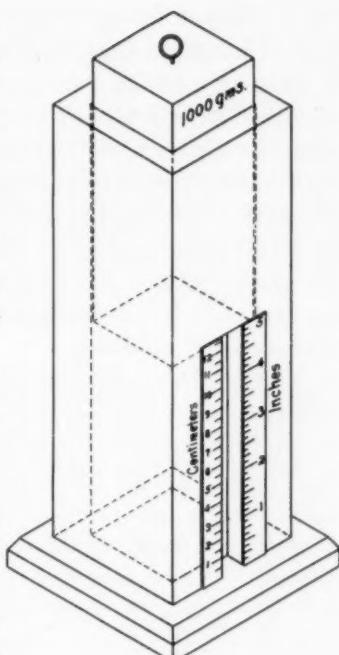
J. R. Katz (Gelatinization and Retrogradation of Starch in Relation to the Problem of Bread Staling.—A Comprehensive Survey of Starch Chemistry, Vol. I, pp. 100-117) mentions three methods of showing differences between fresh and stale bread—these are hardness, swelling power, and soluble starch. To determine hardness of bread, he designed a special type of tester, with which the penetration depth in bread crumb of a small disk of 22.5 mm. diameter was determined. The disk was loaded with a weight of 50 grams and allowed to act for 180 seconds. The resulting figures in millimeters were taken as the hardness of the crumb.

Washington Platt [Staling of Bread, Cereal Chem. 7: 1-34, (1930)] describes an apparatus for accurately measuring the compressibility of the crumb of bread. He states that "change in compressibility so measured indicates the rate of staling."

Several years ago, in the then Bureau of Chemistry, there was designed a very simple box, and plunger which, while crude, has been found suitable for making comparative compressibility tests of bread and similar baked products. There are such large differences in the compressibility of fresh bread and bread that is one day old that even a crude apparatus is sufficiently sensitive to show relative values. The box in question is made of wood, 2"x2"x9" inside dimensions, mounted on a base 4½"x4½"x3¼". In one side of the box is a window ½"x5". A glass is fastened on the inside of the window so that it is flush with the inner surface of the side. Inside of the box is a weighted block 1 15/16" x 1 15/16"x5". Sufficient lead is used in weighting the block to make the combined weight of lead and block 1000 grams. A hook is fastened in the

block to aid in handling it. The box and plunger are waxed to protect the wood from changes in atmospheric moisture. The plunger is made just enough smaller than the inside of the box, to slide freely, and at the same time be guided so that the weight is applied vertically. The size of the prism of bread is such that it will not touch the sides of the box even when compressed.

In using this apparatus a prism of bread  $1\frac{1}{2} \times 1\frac{1}{2} \times 2''$  cut from the interior of the loaf is placed on the bottom of the box and centered, then the weighted plunger is carefully lowered until it rests on the bread. At the end of 1 minute a reading can be taken by noting on the scale at the side of the window the level of the bottom of the plunger. Differences in readings of different prisms taken from the same loaf at different periods indicate the progress of staling as measured by lack of compressibility or by firmness.



*Compressibility Tester*

## A NEW TYPE OF FERMENTATION CABINET

C. H. BAILEY

General Mills, Inc., Minneapolis, Minn.

(Read at the Convention, May, 1930)

The development of a satisfactory fermentation cabinet presents problems common to many phases of biological investigations which involve temperature and humidity control. Any cabinet or air thermostat which is operating at a temperature above that of the atmosphere in the room will lose heat energy into the room in consequence of conduction of heat through the walls of the cabinet and of the loss of warm air into the room when the doors of the cabinet are opened.

To maintain a constant temperature in the cabinet necessitates the release of heat energy in it, which is equivalent to the heat energy that is being lost. Since heat energy must commonly be

released at a limited number of points in the space within the cabinet, it becomes further necessary to promptly and effectively distribute this added heat energy throughout this space.

In a practical way the most convenient release of heat energy can be effected through the use of open-coil electrical heating elements, and the distribution of this heat energy as it is released can then be accomplished by circulating the air in the cabinet. This circulation must be so effected as to insure a movement of air through the coil heating elements, and a regular and systematic movement of this heated air through all parts of the space to be occupied by the doughs.

At certain seasons of the year, particularly in the summer months, the temperature of the atmosphere in the room may at times be above that which is desired in the cabinet. Under such circumstances the situation is the reverse of that outlined above, and heat energy tends to move into the cabinet from the warmer atmosphere without. Under such circumstances this additional heat energy must be removed by providing facilities for cooling the air in the cabinet. Several means at once suggest themselves to this end. The simplest perhaps is to place a cake of ice, or a quantity of cracked ice in a suitable metal box or container and circulate the air about the cool surfaces of the container. A Frigidaire or G. E. cooling block can also be used in cooling the circulating air. When cooling is attempted it is desirable that valves be provided so that either a part or all of the circulating air may move through this cooled space. When the cooling to be effected is slight, as for example when the temperature of the room is only a few degrees above that of the operating conditions in the cabinet, it is undesirable to move all of the air through the compartment in which the ice container is placed, since this merely tends to melt the ice faster than is necessary.

As will be seen from the section of the interior of the cabinet (Fig. 1) provision has been made for locating a can or box containing ice or a refrigerator cooling block in the upper left-hand compartment. At the right of this compartment louvres have been located to facilitate the adjustment of the volume of air moving through this space. When a minimum of cooling is desired these louvres will be nearly closed and the louvres of the bypass compartment immediately below the cooling block will be opened widely. On the other hand, when maximum of cooling is requisite to the operation of the box, the lower louvres will be closed and the upper ones opened to their full dimensions.

A greater uniformity of temperature in all parts of each chamber can be effected if the box be "precooled" before baking operations commence; that is, if the temperature of the circulating atmosphere be reduced by 5° C. below the operating temperature for an hour. In this manner the reservoir of heat in the walls of the cabinet is fairly well dissipated before dough is placed in the cabinet, thus bringing the actual temperature of these walls to about the operating temperature. If this is not done, there may be a temperature gradient in each compartment which will persist for about two hours, or until the walls are cooled.

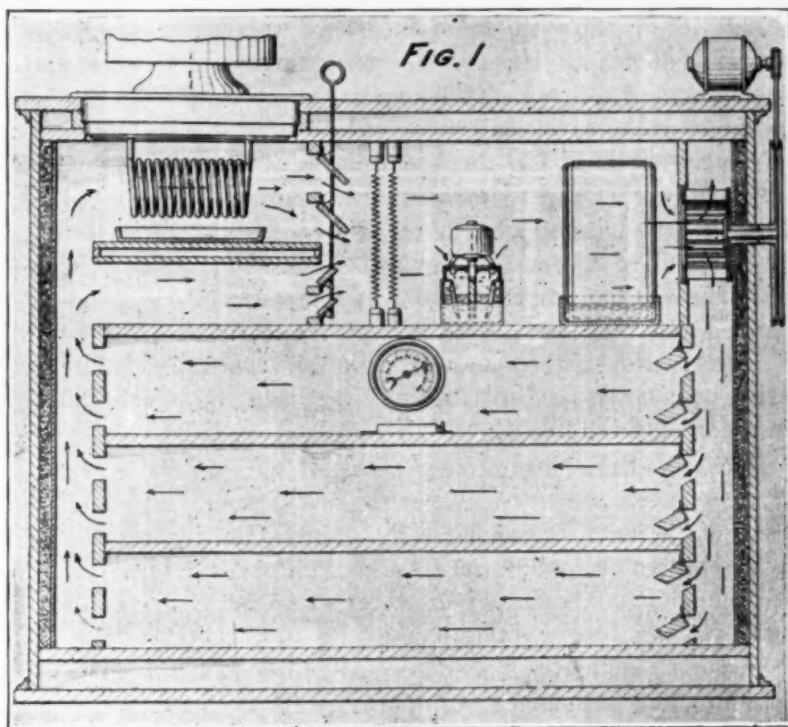


Fig. 1. View showing Constructional Details of Fermentation Cabinet.

Note also that these louvres are so placed as to direct the air leaving the lower or by-pass compartment upward, and the air leaving the upper or chilled compartment downward, so that the two currents of air tend to mix at the point where they are to pass through the heating elements located immediately to the right.

Humidity control is also desirable for the most effective operation of such a cabinet. In the winter months in particular it be-

comes necessary to vaporize a considerable quantity of water in order to maintain the humidity of the atmosphere in the cabinet at a level which will obviate the crusting-over of exposed dough surfaces. In constructing this cabinet provision was made for space in which to house suitable humidifying devices.

A manual control of the introduction of water vapor can be effected by locating a simple device to support wicks dipping in a pan of water immediately in front of the sirocco fan (Fig. 1). These wicks, made of rough Turkish toweling, have been suspended in this situation with their flat side or long axis in a plane parallel to the direction in which the air is moving, or, in other words, lengthwise of the compartment. This arrangement provides a maximum of evaporating surface with little interference with air movement, and a dozen such wicks will rapidly and effectively raise the vapor pressure in this space to the working level even when the relative humidity in the atmosphere of the room is as low as 20 per cent.

When the humidity in the room is higher than 20% it may become necessary to remove certain of these wicks, and as atmospheric humidity approaches the optimum the wicks may be entirely removed and recourse had to an automatically controlled humidifier, such as the small model made by the Bahnson Company. One of these is shown in Fig. 1, located between the heating elements and the wick humidifier.

A combination of the two types of humidifiers may be conveniently made, which results in the wicks supplying a portion of the requisite water vapor while the automatically controlled Bahnson or similar humidifier serves as a "booster" device which supplies the additional quantity of water vapor necessary to the maintenance of the desired humidity.

A wiring system has been devised which makes possible a rapid and controlled elevation of temperature in the box when it is first warmed up from a cool state to the operating temperature. Two banks of heating elements are provided. Through the use of a single-pole double-throw switch these banks can be thrown either series or parallel. This is a familiar trick of the electrical heating engineer. In parallel they liberate several times as much heat energy per unit of time as when in series. When the heating elements are arranged in series they are in series in turn with the thermo-regulator which is located at some convenient point in one of the dough chambers.

In the design shown in Figure 1 three dough chambers at as many levels have been provided. Each of these is separate from the others but draws a supply of warmed (or cooled, as the case may be) and humidified air from the vertical duct at the right of the cabinet. This air moves horizontally across the three levels and enters the vertical duct at the left-hand end of the box, whence it rises to the air-conditioning compartments across the top of the cabinet. Louvres have been provided at both ends of each of these three dough compartments to facilitate the adjustment and control of air movement through them.

In operating these boxes it has been found that more uniform temperatures are encountered in all parts of each dough compartment if a single wetted wick is placed across the right-hand end of each compartment where the warmed air enters. Such a wick can be supported above a narrow tank or metal can which occupies little space.

With these facilities for warming and cooling the air, as circumstances may require, adding water vapor to the air and then circulating this air through the dough compartments or chambers, a uniformity of control appears possible. In the designing of this new cabinet every effort has been made to make it as simple as possible. It is recognized that additional controls might have been provided, but these all add to the cost of the device and may require considerable supervision and adjustment on the part of the operator.

The cabinet here described, combined with the exercise of some intelligence in the matter of the settings of louvres, supplying humidifying wicks, and other adjustable facilities, has seemingly given excellent satisfaction under conditions of heavy operation. While application for Letters Patent covering this device have been made, it is anticipated that arrangements will be made so that its advantages may become available at reasonable cost to any laboratory that desires to make use of it.

## CALIBRATION OF LOAF VOLUME MEASURING DEVICES WITH METAL MODELS

C. H. BAILEY

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(Read at Convention, May, 1930)

When the conventional method for the determination of the cubical displacement of loaves of breads is attempted through the use of rape seed or mustard seed, errors of measurement are almost invariably introduced in the event that the volume of the loaf is estimated from calculations based upon the calibration of the loaf volume box and the accompanying burette with water.

A procedure for overcoming certain of these difficulties was suggested by Harrel (1928), which involved the use of a rubber balloon filled with varying quantities of water. The volume of the filled balloon could be determined by weighing and correcting for thermal expansion of the water as a function of temperature. Two points on a graph could thus be determined by using two different quantities or volumes of water in the balloon and plotting the volume of seed as measured in the burette as abscissas and the true volume of the filled balloon as ordinates.

Heald (1929) made four observations with the balloons, establishing as many points on his graph, and proceeded to plot "apparent" volume against "true" volume. He found that these four values fell on a straight line. The data included in his tabulation indicate that the error or difference in cubic centimeters between the true volume and the apparent volume tended to diminish as the volume of the balloon was increased.

The use of the rubber balloon filled with varying quantities of water, while reasonably satisfactory, is open to certain objections in the matter of convenience. Moreover it is possible that the errors in filling the loaf volume box may vary somewhat with the shape of the object to be measured. If this were true, then the nearer one could approach to the shape of a loaf of bread, the more satisfactory would become the calibration of the devices, particularly in view of the fact that this calibration is essentially an empirical operation at best.

There are other obvious advantages attached to the calibration of a number of loaf volume devices in as many laboratories when the "true" volume points are in the same position on the graph in each instance. This cannot be attained satisfactorily through the use of balloons but is possible if solid models of loaves be employed.

To facilitate this calibration of loaf measuring apparatus we proceeded to have the model makers prepare four wooden models from dimensions taken from actual loaves of bread of as many different sizes. These wooden models were then turned over to a foundry with the stipulation that hollow aluminum castings were to be prepared. These castings are shown in the illustration. They could be rendered water tight and in this condition their true volume was accurately determined by weighing them in the air and again in water of known temperature. After making the necessary corrections for thermal effects, their volume at 20° C. was found to be 322, 429, 561, and 659 cubic centimeters respectively. The weight of these hollow aluminum models is not much greater than loaves of equal size.

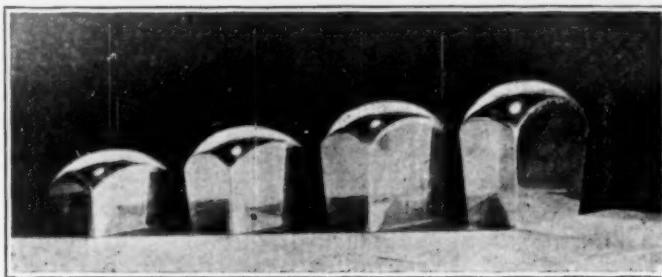


Fig. 1. Aluminum Models used for Calibration of Loaf Volume Devices

It must be recognized that in any event the calibration of a loaf volume device is essentially empirical, and it therefore becomes necessary to lay down specifications for the use of the apparatus in each instance. The manner of introducing the seed into the loaf volume box, striking off the mustard seed level with the top of the box, and several other details must be done in a uniform manner, both in standardizing and in subsequently using the same device with the actual loaves. With the ordinary 100 gram loaf, and the loaf volume box and burette built after specifications suggested by Werner and constructed by one of the instrument houses, it only becomes necessary to note the volume of seed in the burette after the measurement of the loaf of known displacement. The four readings thus secured with the four models are then plotted with volume of seed in the burette as ordinates and true volume as abscissas. From the graphic representation of the relation between these two variables it then becomes possible to organize a tabulation of these equivalents.

Loaves have occasionally been encountered which were too tall to be measured in the box designed by Werner. It became necessary therefore to have a deeper box constructed. This box can be calibrated against the burette in exactly the same manner as in the instance of a smaller box, and the corresponding values recorded on the same graph, with the numerical equivalents on both axis changed accordingly.

The use of these models has apparently given satisfaction thus far in the standardization of a number of these devices. It also makes possible the checking of the actual technique in different laboratories.

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### REPORT OF THE COMMITTEE ON THE STANDARD BAKING TEST

C. H. BAILEY, Chairman

(Read at the Convention, May, 1930)

The Committee on the Standard Baking Test for the fiscal year 1929-1930, was comprised of C. G. Harrel, Rowland J. Clark, Harry E. Weaver, M. J. Blish and C. H. Bailey. This committee held two formal meetings, one on the occasion of the last day of the Convention at Kansas City in May, 1929, and the second on May 4, 1930.

At the committee meeting in 1929 it was decided that an effort would be made to raise a fund adequate to the support of a Research Fellowship. Mr. C. G. Harrel, in his joint capacity of Chairman of the Executive Committee, as well as member of this Committee, undertook the difficult task of raising this fund. As his sub-report will indicate, a large measure of success has attended his effort, and he is to be commended for the energetic and judicious manner in which he prosecuted this heaviest task of the Committee for the year.

The pledging of the money to the support of this fund required so many months of the fiscal year as to result in some doubt concerning the success of the enterprise until a large fraction of the year had elapsed. For this and several other reasons it appeared undesirable to attempt the expenditure of these funds until after the 1930 Convention.

In the interval the Committee has entered into correspondence

with numerous research institutions, with a view toward securing the requisite cooperation in maintaining such a research fellowship as was contemplated. Excellent responses were secured from a number of institutions, including the Bureau of Agricultural Economics of the U. S. Department of Agriculture; the Bureau of Chemistry and Soils of the U. S. Department of Agriculture; the Nebraska Agricultural Experiment Station; the Kansas Agricultural Experiment Station; and the Minnesota Agricultural Experiment Station. The Mellon Institute of the University of Pittsburgh and the Massachusetts Institute of Technology indicated some interest in the matter, but set up conditions which it was felt our Association could not meet at this time.

The Committee, in a formal meeting on Monday, May 5, 1930, considered the facilities afforded our work by these several institutions, and recommend to the Association that the Fellowship be placed at the University of Nebraska. It will be assumed that with the approval of this report by the Association this selection of the University of Nebraska for this work meets with the favor of the Association.

Various means were utilized in an effort to secure application for this Fellowship from as many chemists as possible, in order that we might thus become aware of the best talent which could be made available to us. A dozen bona fide applications resulted from the publicity given this project. After careful consideration of qualifications of these applicants, the Committee has selected the names of a preferred candidate, and an alternate, and negotiations will be opened with the former just as soon as a final agreement is had with the University of Nebraska. It becomes necessary to leave this matter of appointment open until these arrangements respecting location of the Fellowship are concluded, since this might have some bearing upon the interest which the candidate selected might have in accepting such an appointment.

The Committee feels that in this stage of the development of the work on the Standard Baking Test it is desirable that we thus proceed slowly and carefully, to insure that the best possible use is made of the funds collected. We feel confident that arrangements are about to be set up which will afford very satisfactory facilities to the prosecution of several lines of investigation which apparently can only be handled through the strenuous and uninterrupted or full-time work of a qualified cereal chemist.

Despite this reduced activity on the part of the Committee, certain events have been marching toward a possible solution of

some of our problems. Thus, for example, the attention of certain members of the Association and of engineers in the allied trades has been directed toward the development of mechanical facilities for handling the small or 100 gram baking test. You will recall that when the work on this test was first started it then appeared necessary to mix doughs by hand. Now there seems to be likelihood that mechanical dough mixers may be made available for handling these small doughs as effectively as the larger or one pound doughs have been handled in the past.

Again, the matter of effective control of temperature and other conditions in the fermentation cabinets and ovens was stressed in the report of the Committee a year ago, and attention has been given to these important details as expressed in new devices which are now being made available or will subsequently be made available to baking test laboratories.

The matter of measuring the actual volume of the small loaves resulting from the application of this testing practice has also been emphasized in several publications in Cereal Chemistry, and the chairman of the Committee in a special report will call your attention to the manner in which the various devices available for measuring loaf volume may be conveniently standardized with the requisite accuracy.

Mr. Heald of the Commander-Larabee Corporation in Kansas City has already reported to the Convention the results of his experience with the modified Swanson Mixer. Mr. T. R. Aitken of the Dominion Grain Research Laboratory, Winnipeg, Canada, communicated a paper on an automatic proofing device. The May issue of Cereal Chemistry contained a description of a loaf volume apparatus devised by Malloch and Cook of the University of Alberta (Edmonton, Canada). All of these contributions represent progress that is being made in the general direction of unifying practice and providing requisite mechanical facilities to that end.

It is anticipated that reports of progress will be organized by the Research Fellow and his advisor in the institution to which he is attached, which will be published in Cereal Chemistry from time to time as the stage of the work warrants. In this manner the members of the Association and those who contributed to the research fund can be apprized of the results of work that is going forward. In this connection, however, the Committee urges that final judgment respecting the significance of the several variables to be studied by the Research Fellow be reserved until the work has advanced far enough to justify conclusions.

## Baking Characteristics of Various Types of Wheat as Reflected By Different Baking Procedures

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The one important factor concerning the efficiency of any experimental baking procedure is the value of the information obtained from the results. Does the procedure cause the strong flours to stand out and the weak flours to fall down? Does it prove a reliable guide in selecting the right kind of wheat to go into the mill mix or is the treatment so mild that even a weak flour makes a good loaf of bread?

In order to make a study of the results obtained by different baking procedures six samples of wheat showing considerable variation in chemical analyses and appearance were ground on an Allis-Chalmers Experimental Mill and the flours baked by the following methods, all of which are modifications of the A.A.C.C. Method.

**Method I.**—Doughs were given 3 hours and 20 minutes fermentation at 82° F., (27.7° C.) using the following formula: 2½% sugar, 1¾% salt, 3% yeast and 2% shortening. This was considered as a fairly long fermentation time with a formula nearer commercial practice than the A.A.C.C. formula.

**Method II.**—Doughs were given 2 hours and 40 minutes fermentation at 80° F., (26.6° C) using the A.A.C.C. formula, which is 2½% sugar, 1% salt, and 3% yeast. This is 20 minutes shorter fermentation time and 6° lower temperature than the A.A.C.C. procedure.

**Method III.**—The A.A.C.C. basic procedure and supplements B and C, with modifications which consisted only in machine mixing and adding water as required. The A.A.C.C. basic procedure is essentially the same as that described by Werner (1925).

The doughs were mixed and handled in the same manner for all three methods. Stock solutions were used and the doughs were mixed with a machine having a battery of six bowls so that six doughs could be mixed at the same time. The flours were weighed out on a 13.5% moisture basis. In each of these methods sample No. 1 was taken as the standard. The loaves from the other samples were scored against the loaves from this flour.

TABLE I  
CHEMICAL ANALYSES AND WATER ABSORPTION (13.5% BASIS)  
OF THE SIX FLOURS USED IN THESE EXPERIMENTS

Flour	1	2	3	4	5	6
Absorption, %	57.7	59	58.7	59.5	56.5	51.8
Ash, %	.44	.47	.43	.42	.43	.39
Protein, %	11.90	14.90	12.80	11.20	11.00	8.50

The results produced by Method I are shown in Table II. Each figure in this table represents the average of four separate baking tests. The scoring system used in this work is original in our laboratory.

TABLE II—(METHOD I)  
FERMENTATION TIME 3 HOURS AND 20 MINUTES AT 82° F. (27.7° C.)

Flour	1	2	3	4	5	6
Crust Color	5	3	3 $\frac{1}{2}$	5 $\frac{1}{2}$	1	4
Crust Character	5	5	5	5	3 $\frac{1}{2}$	3 $\frac{1}{2}$
Crumb Color	10	6	11	11	7	V. Y.
Grain and Text.	10	9	10	11	T.	10 S.T.
Loaf volume, cc.	600	605	570	565	520	510

In scoring *crust color* the range is from 6 to 0 with 5 representing the standard or a dark golden brown. Score is lowered progressively as color becomes pale.

*Crust character* is scored on basis of five points with 5 representing a bold, smooth, unbroken development, having a pronounced break with smooth shred. As break becomes rough and ragged, approaching a shell top, score is decreased progressively to zero.

*Crumb Color* is scored on a basis of approximately 10 points with 10 representing the standard and a diminishing or increasing score as the color varies from the standard.

*Grain and Texture* is scored on same basis as crumb color with the addition of a few descriptive terms. The letter T designates a tight or solid crumb structure, which is a very reliable sign, indicating that the gas-producing power of the flour is becoming exhausted. V. T. denotes a very tight or solid crumb structure, and S. T. denotes slightly tight.

*Loaf volume* is determined with the Werner apparatus which has been calibrated.

In examining the data in Table II it will be seen that the loaf produced by Sample No. 1 scored high in every respect. The crust color score shows that a good loaf of bread can be expected over a fairly wide range of fermentation.

Sample No. 2 produced good volume but had a poor crumb color, and a rather pale crust. The crust color of this loaf shows that it will not withstand a long fermentation.

Sample No. 3 compared favorably with No. 1, with the exception of crust color and slightly lower volume.

Sample No. 4 shows baking characteristics all of which compare favorably with Sample No. 1, except for slightly reduced volume.

The absorption of Sample No. 5 was rather low and none of the other baking characteristics show up very well by this method. From the pale crust color and tight or solid crumb, it is quite apparent that the gas supply in this dough was nearly exhausted.

Sample No. 6 scored low with the exception of crust color.

Table III shows the results obtained by Method II.

TABLE III—(METHOD II)

FERMENTATION TIME 2 HOURS AND 40 MINUTES AT 80° F. (26.6° C.)

Flour	1	2	3	4	5	6
Crust Color	5	4	5	5 ½	2 ½	4
Crust Character	5	5	5	5	5	5
Crumb Color	10	6	11	12	7	V. Y.
Grain and Text.	10	10	10	10	10	10 S. T.
Loaf Volume, cc.	595	585	560	570	510	515

The relationship of the baking characteristics of these six flours to each other, as shown in Table III, is with the exception of crust color very much the same as shown in Table II. It appears that this method does not show as large a variation in crust color between these flours as does Method I. It is certain, however, from the results of other experiments performed with this formula and temperature, that if the fermentation time is lengthened approximately 25 minutes, the same information is obtained with this method as with Method I. It appears that modifying the A. A. C. C. method to the extent of lowering the dough temperature 6° F. and shortening the dough time 20 minutes, does not produce a sufficiently vigorous fermentation to show up the diastatic deficiencies of a dough unless the flour is decidedly weak in this respect.

Table IV shows the results obtained by Method III, or the A. A. C. C. Basic Procedure with the exception of machine mixing and absorption. In this case water was added in a sufficient amount to bring the dough to what we considered the proper consistency.

TABLE IV—(METHOD III)  
FERMENTATION TIME 3 HOURS AT 86° F. (30° C.)

Flour	1	2	3	4	5	6
Crust Color	5	2	2	5 ½	1	2 ½
Crust Character	5	3	3	5	1	3
Crumb Color	10	4	6	12	4	V. Y.
Grain and Text.	10	V. T.	T.	10	V. T.	T.
Loaf Volume, cc.	575	415	465	560	375	500

The results in Table IV show that this method is much more severe than either of the other two. Judged by this procedure there is no doubt but that the fermentation tolerance of Nos. 2, 3 and 5 is rather small. The gas supply in Sample No. 5 was entirely exhausted while No. 3 withstood this treatment slightly better than No. 2. Nos. 1 and 4 still scored high. No. 6 had a peculiar reddish cast to the crust color, making it difficult to score, but the depth of color indicated that it had a fair amount of diastase. Although most of the baking characteristics of this flour scored low, the sugar in the dough does not become exhausted and it produces approximately the same volume under all three of the methods.

All of the results obtained by Method III can be easily predicted from the crust color scores in Table I. These results very definitely support the conclusions of Blish and Sandstedt (1927), where they state that fermentation tolerance is almost entirely associated with the gas production factor; i.e., sugar or diastase. The flours scoring high in crust color in Table I withstand the treatment of Method III well, while those scoring low, such as Nos. 2, 3 and 5, appear very weak by this baking method. We also demonstrated many times that by increasing the fermentation time of Method I approximately 1 hour, or to a total of 4 ¼ hours, we obtain approximately the same results as we do with the A. A. C. C. procedure, using 3 hours dough time. Of course, Method I produces superior loaves but the relative differences between different flours are the same.

In examining the results recorded in Table IV, it appears that the A. A. C. C. Basic Procedure has too severely taxed the diastatic capacity of Nos. 2, 3, and 5. The tight, solid crumb structure and small volume show that the gas-producing power of these flours was nearly exhausted. It is possible that some good qualities which these flours may possess have been obscured by a too strenuous fermentation process. Consequently, these six flours were next baked by the A. A. C. C. Basic Procedure, using Supplement B,

which consists in varying the fermentation time. In this case the fermentation was shortened 30 minutes.

TABLE V—(METHOD III)  
FERMENTATION TIME 2½ HOURS AT 86° F. (30° C.)  
OR 30 MINUTES LESS THAN BASIC PROCEDURE

Flour	1	2	3	4	5	6
Crust Color	5	2	3	5	1	3
Crust Character	5	4	5	5	3	3
Crumb Color	10	6	9	14	8	V. Y.
Grain and Texture	10	8	10	11	V. T.	9
Loaf Volume, cc.	600	545	550	610	505	545

The weak flours were scored higher by this method, which demonstrates that some of these samples can withstand only a short fermentation. It can be readily predicted, however, by the crust color, what these flours will do under a long fermentation. The results in Table V do not exactly parallel those in Table II, but by studying these two tables it can be seen that both of these methods give practically the same information regarding these six flours. The results in Table V, however, were obtained in 50 minutes shorter time.

Thus far it appears that Nos. 1 and 4 are the only strong wheats in this group. A large percentage of wheats like Nos. 2, 3, and 5, might be very detrimental to any wheat mix. Flour made from such wheats would not give a baker much leeway in the handling of his doughs. A delay of 20 or 30 minutes after the doughs were ready for the make-up might cause serious trouble, but aside from this lack of fermentation tolerance, these flours may have some very good qualities not brought out by these baking procedures. Consequently, these samples were next baked by the A. A. C. C. Baking Procedure using Supplement C, which consists in adding 1 mg. potassium bromate to the dough. The results obtained by this method are shown in Table VI. For the sake of comparison, results using Supplement C are shown beside the results of the Basic Procedure so that the effects of the bromate can be readily seen. All loaves of both of these series were baked the same day and scored together.

Nos. 2 and 3 show a very decided improvement in crumb color and loaf volume, due to bromate, and a noticeable improvement in crust color. The grain and texture, however, was somewhat broken down, having large, elongated holes.

Nos. 1 and 4 show substantial improvement in most characteristics and practically no deteriorating effect due to bromate.

Nos. 5 and 6 show little change due to the bromate. The crumb color of No. 5 was improved substantially but otherwise it appears that the dough from this flour was very much exhausted from the effects of this fermentation, leaving little opportunity for the bromate to work effectively one way or the other.

TABLE VI—METHOD III  
A.A.C.C. PROCEDURE—3 HOURS, 86° F. (30° C.)

Flour Supplement	1		2		3	
	Basic	C	Basic	C	Basic	C
Crust Color	5	5	2	3	2	3
Crust Character	5	5	3	3	3	4
Crumb Color	10	13	4	11	6	16
Grain and Texture	10	10	V. T.	B. D.	T.	Sli. B. D.
Loaf Volume, cc.	575	615	415	520	465	575
Flour Supplement	4		5		6	
	Basic	C	Basic	C	Basic	C
Crust Color	5½	6	1	1	2½	2
Crust Character	5	5	1	1	3	3
Crumb Color	12	15	4	7	V. T.	V. Y.
Grain and Texture	10	10	V. T.	V. T.	T.	T.
Loaf Volume, cc.	560	595	375	395	500	485

The data obtained by the Basic Procedure show the baking score of Nos. 2, 3, 5, and 6 to be low, and Nos. 1 and 4 to score high. The data obtained by the bromate test shows us that some of these flours, although having a rather narrow fermentation tolerance, respond tremendously to 1 mg. potassium bromate, such as Nos. 2 and 3, and that some are indifferent to the action of bromate, such as Nos. 5 and 6. In order to determine the real magnitude of the effect of bromate upon Sample No. 5, it would be necessary to use this test with Supplement B, using a shorter dough time. By the Basic Procedure this dough is so much exhausted that there is no opportunity for the bromate to react. The same is true of Nos. 2 and 3, but to a lesser extent. In fact, subsequent tests with flour No. 2, using Method III, plus 2 mg. of bromate, produced a loaf volume of 855 cc.

What the significance of this response to bromate is cannot be stated definitely but it appears quite certain from experiments performed in this laboratory as well as literature published on this subject that a strong positive reaction of any flour to bromate is desirable.

The results by the various procedures reported in this paper seem to demonstrate clearly that the magnitude of the response

to bromate has no connection whatsoever with the fermentation tolerance of the dough. We have an abundance of data not included in this report, which supports this conclusion. We also have a limited amount of data showing that there is a rather strong relationship between the response of the flour to bromate and its ability to stand up against dosages of improvers and yeast nutrients commonly used in the bake shop.

### Summary and Conclusions

Using six flours of varying characteristics, the A. A. C. C. Baking Procedure was compared with two other methods, one of which differed primarily in fermentation time and temperature, and the other in fermentation time, temperature and formula. From these results the following conclusions have been drawn.

1. In order to differentiate between flours varying in strength, a baking formula must have time and temperature so adjusted that diastatic capacity is severely taxed.
2. The A. A. C. C. procedure is the most efficient of the three methods employed as it produces the same information, such as variations in crust color and differences in loaf volume, etc., in the shortest time.
3. The A. A. C. C. Baking Procedure with Supplement C (addition of bromate), emphasizes desirable characteristics or deficiencies in wheats which the Basic Procedure alone fails to reveal.

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### Hand Molding vs. Machine Molding

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The hand molding of dough in experimental baking procedure has long been recognized as a source of error in the true volume as determined by duplicate loaves of the finished product. Baking experience with the tall narrow loaf, such as is made by many commercial and mill laboratories show considerable variation in the size of the finished loaf baked from the same flour. This is true regardless whether the type is determined by displacement with seed or by the use of a cloth tape. Bakings made using the cottage type loaf where the volume is measured by the displacement of seed from an apparatus relatively accurate will show variations in loaf volume of about 6%.

With the introduction of the still smaller style loaf or the Standard Experimental Baking Test type sponsored by this association, hand molding still appears to be a serious factor in arriving at concordant results.

Moen (1929) indicated in the Baking Committee Report that two individuals molding the same flour according to the prescribed method outlined by Blish (1928), will obtain variations in the order of 5.4 per cent. Experience in the laboratory with which we are associated, indicates an error of similar magnitude. Recognizing this source of error Blish (1927) and Harrel (1929) in the Baking Committee Report of this association, draw attention to the variability produced by hand molding the small doughs and although pointing out that this variability is somewhat less than one experiences with the one-pound loaf, express the thought that the source of error should be eliminated and suppose that perhaps machine molding would be preferable as it would handle doughs uniformly and eliminate the personal equation in experimental baking. Consequently, when the small loaf was adopted for experimental work in the Milling and Baking Laboratory of the Bureau of Agricultural Economics, the development of a molding machine technique was given extended study.

A Thomson One-Man molder type "I" was available. The type "I" molder was designed to handle the large loaf. After considerable experimentation it was reconstructed as follows:

(1) A small wooden hopper 3" x 6" at the top and 3" x 3" at the bottom was inserted directly above the steel compressing rolls. This box prevented the dough from passing through the rolls at an angle.

(2) The steel compressing rolls were set  $\frac{1}{8}$ " apart producing a sheet of dough relatively free from gas.

(3) After the dough has been curled into the form of a loaf it passes downward through a wooden guide 4 $\frac{1}{2}$ " wide and falls on to a traveling belt.

(4) Wooden slats were inserted adjacent to the upper level of the traveling belt leaving an opening 3 $\frac{1}{2}$ " by 1". The dough is carried along the upper level for a distance of two feet and is then dropped to a lower level where slats have again been inserted adjacent to the traveling belt with an opening 4" by  $\frac{3}{4}$ ". The

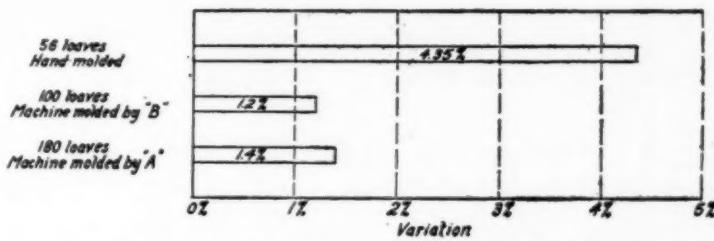


Fig. 1. Comparison of Variations in Hand and Machine Molding.

dough thus formed is approximately 1 $\frac{3}{4}$ " in diameter and 3" long and fits the baking pan without any further manipulation.

The bakes reported in this paper were made according to the formula described by Blish (1928) which has been accepted as the tentative Standard Experimental Baking Test.

The following modifications of the basic procedure have been made in conducting this study:

(1) 200 grams of flour have been mixed in a mechanical mixer and divided equally before fermenting.

(2) Machine molding has been used throughout except for 56 loaves where hand molding was used.

Although much data is available to bear out the differences in duplicates produced by hand molding, it was found desirable to repeat a sufficient number of loaves which could be used as a means of comparison to machine molding. Figure 1 shows the results of 56 hand molded loaves having a variation of 4.35%. Also in this same figure is shown results obtained on 280 loaves machine molded by two different individuals, "A" and "B".

One hundred loaves molded by "B" show a difference of 1.2%, while the 180 loaves molded by "A" reveal a difference of 1.4% between duplicate bakings. It is obvious then that mechanical molding results in reducing the error between duplicates as well as the loaves produced by different individuals. Thus far we have discussed results obtained by baking a single flour in duplicate accounting for any difference in volume to molding, as temperatures, humidity, and mixing time of the doughs are held constant. With each day's baking four control loaves, two at the beginning and two at the completion of the day's bake, are made from the same flour.

Figure 2 shows graphically 272 loaves, 176 baked while the molder was undergoing slight changes in construction and 96

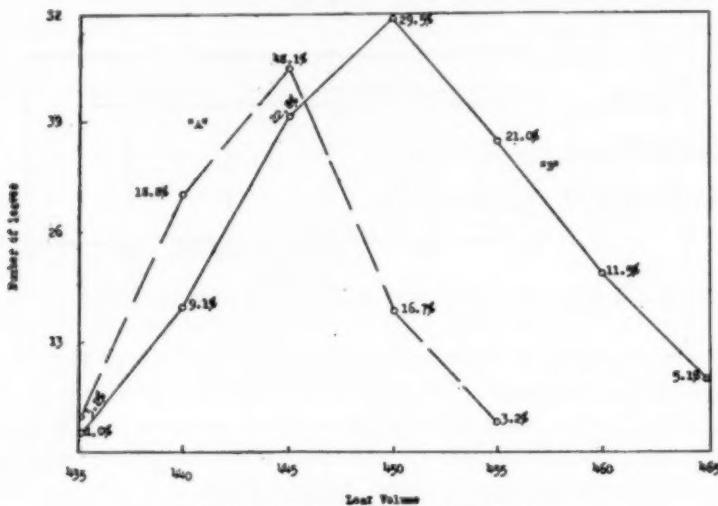


Fig. 2. Distribution of Loaf Volumes.  
Curve "A": 96 loaves baked after alteration of molder.  
Curve "B": 176 loaves baked during alteration of molder.

loaves after the completion of such mechanical alterations. It is evident from curve B that the 176 loaves varied by 6.5% or 30 cc. in volume from one extreme to the other. Yet 84.8% of the loaves did not show a variation of more than 5 cc. or 1.3%, which is also the average variation of four loaves baked on any one day. Two reasons for such a variation of 30 cc. in this series may be advanced. The yeast supply may not be uniform, although each day's bake is made from fresh yeast which to our knowledge is not over two days old. Secondly, the mechanical changes made on the molder during this series may be responsible in no small measure for such difference in extremes. The latter reason seemed more plausible,

so 96 more loaves were baked, while the adjustments on the molder remained the same throughout. Expressed graphically on Figure 2, curve A, the spread in volume has been reduced to 20 cc. with 90% of the loaves falling within a  $\pm$  5 cc. range. The variation in duplicates did not exceed 1.2%, agreeing with the variations obtained on the first series of 176 loaves.

Figure 3 shows separately the average variation of the five commercial classes of wheat.

The protein contents of these flours range from 6% in soft winter wheat to 19% in hard spring wheats and represent a cross section of the varieties usually met with in commercial practice. The ash content, gluten quality, and break-baking properties also vary considerably.

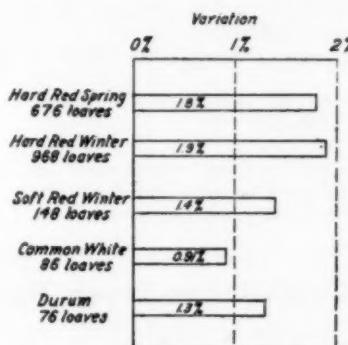


Fig. 3. Average Variation of Five Commercial Classes of Wheat.

The classes are listed in graphic form as follows:

The Hard Red Spring wheats, including such varieties as Marquis, Kota, Preston, Ruby, Power, Java, Progress, Marquillo, etc., show a variation of 1.8% for 676 loaves.

The Hard Red Winter wheats including such varieties as Turkey, Kanred, Blackhull, Karmont, Minturki, Montana No. 36, and a great many commercial samples bearing a U. S. Grade number, collected at the various supervision offices, show a variation of 1.9% on 968 loaves baked.

The Soft Red Winter wheats show a variation of 1.40% on 148 samples. Included among these were such varieties as Fulcaster, Fultz, Leap, Harvest Queen, Currell, Gold Drop, Poole, and Trumbull.

The Common White wheats with such varieties as Baart, Dicklow, Gold Coin, Hybrid 128-63-143, Jenkins, Federation, and Hard Federation, shows a variation of 0.91% on 86 loaves.

Durum wheats, of which only 76 loaves are reported, show a variation of 1.30%. The varieties included in this series are Kumbanka, Pentad, Monad, Acme, Mindum, and Nodak.

### Conclusions

Hand molding introduces a variation of 5.4% between duplicates.

Machine molding by the same or different operators will evidence variations as high as 1.9%.

A single flour from which 96 loaves have been baked show that 90% fall within a  $\pm$  5 cc. range.

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### Report of Sub-Committee on Dough Thermometers

R. C. SHERWOOD

General Mills, Inc., Minneapolis, Minn.

Following the 1929 convention the sub-committee on thermometer specifications continued correspondence with the three thermometer companies who collaborated with the committee, and finally arrived at a set of specifications acceptable to the Baking Committee and consistent with manufacturing practices.

Three thermometer manufacturing companies have submitted satisfactory samples, and have stated that they will supply the thermometers in quantity at moderate cost. A fourth company has recently requested the specifications. The committee has consistently declined to recommend a particular manufacturer. Specifications are available to anyone, and the purchaser may exercise his own judgment in placing his order. Members of A. A. C. C. are urged to adopt the standard dough thermometer so that it will rapidly come into general use and thus aid in accurate temperature measurement and control.

The specifications follow:

### Dough Test Thermometer for American Association of Cereal Chemists

<b>Type:</b>	Etched stem, glass.
<b>Liquid:</b>	Mercury.
<b>Range and Subdivision:</b>	15° to 40° C. in 0.5° or 60° to 100° F. in 1°.
<b>Total Length:</b>	150 to 160 mm.
<b>Stem:</b>	Plain front, enamel back, suitable thermometer tubing. Diameter, $7.0 \pm 0.5$ mm.
<b>Bulb:</b>	Corning normal or equally suitable thermometric glass. Round end. Length, $20 \text{ mm} \pm 2.0$ mm. Diameter, $5.0 \text{ mm} \pm 0.5$ mm.
<b>Distance</b>	to lowest graduation on scale from bottom of bulb, $50.0 \text{ mm} \pm 5.0$ mm.
<b>Distance</b>	to highest point of graduated scale from top of thermometer, $20.0 \text{ mm} \pm 5.0$ mm.
<b>Contraction Chamber:</b>	To be of long narrow type, top to be not more than 35 mm. above bottom of bulb. Mercury to stand in contraction chamber at 0° C (32° F.).
<b>Expansion Chamber:</b>	To permit heating the thermometer to 100° C. (212° F.). Bottom to be not more than 12 mm. from top of stem.
<b>Filling Above Mercury:</b>	Nitrogen gas.
<b>Top Finish:</b>	Glass button.
<b>Graduation:</b>	All lines, figures and letters clear cut and distinct. Each whole degree Centigrade line or the first and each succeeding 5° F. line to be longer than the remaining lines. Graduations to be numbered at each multiple of 5° C. or 10° F.
<b>Immersion:</b>	40 mm. with mark on stem.
<b>Marking:</b>	Each thermometer shall be marked with a serial number and the manufacturer's name or trade mark shall be etched on the stem.
<b>Scale Error:</b>	The error at any point of the scale shall not exceed $\pm 0.25$ C.
<b>Case:</b>	Each thermometer shall be furnished in a metal pocket case with attachment for fastening this to pocket. The thermometer mounted in a removable metal cap which can be screwed on to the metal pocket case.

**Note**—For the purpose of interpreting these specifications the following definitions apply:

The total length is the overall length of the finished instrument, exclusive of case.

The diameter is that measured with a ring gauge.

The length of the bulb is the distance from the bottom of the bulb to the beginning of the enamel backing.

The top of the thermometer is the top of the finished instrument.

## **REPORT OF THE COMMITTEE ON METHODS OF TESTING CAKE AND BISCUIT FLOURS**

MARY M. BROOKE, Chairman

(Read at the Convention, May, 1930)

### **Committee Recommendations, June, 1930**

#### **I. Observations**

1. That from interest displayed at our meeting Monday evening and from numberless inquiries that I receive throughout the year, the need of the study of soft wheat flour is imminent.
2. A large potential membership is to be found among soft wheat flour mills and users, if the Association will take proper recognition of their problems and their solution. As an observation I believe that the Association has been too lax and slow in doing this.
3. The scope and work of the now functioning committee has grown too large for any one committee.

#### **II. General Recommendations**

1. That a larger part of the time and interest of the Association be given over to the study of the problems definitely related to soft wheat.
2. That having made such provision, we then make a concerted effort to draw in to the Association more members working on soft wheat problems. This, for not only the reason of increasing membership, but also to draw into the society, material and man-power to add to our comparatively small fund that we now have.
3. That instead of one committee, several committees or, if preferable, sub-committees, be appointed to carry on the work in the future. It has grown into too large a task for any one person to handle and we also need the ideas of others in the workings of the committee.

#### **Specific Recommendations**

These are recommendations growing out of the several reports of the committee:

1. That we have further work and discussion on the score card system for scoring cake.
2. That a study of creaming time vs. specific gravity of the sugar-shortening mass be made. Recommendations of times for standard baking test have been made by Alexander. We recommend

- their incorporation into the proposed standard baking test method.
3. Recommendations for temperature of creamed mass and also dough mass recommended by Fisher. We recommend their incorporation into the proposed standard method.
  4. Further study should be made of the incorporation of the ingredients. Especial study (preferably collaboration) be undertaken on the Bailey recommendation.
  5. That no change be made for the present in the type of pan proposed for the standard method.
  6. Further study be made on the formula for the proposed standard test. This is work of large scope and should be in a separate committee.
  7. Further study be made with use of viscosity in studying soft wheat flour. This also should be in a separate committee.
  8. More study needed in the problems of soft wheat flours for sweet hard goods, pies, biscuit and crackers. These also should be apportioned to separate committees. They are all highly important and each needs its specific outline of work.
  9. No recommendation is made on the co-relation of the standard test to other cakes. That is an individual problem which would be almost impossible of discussion in a general organization such as this.

#### **Report of Subcommittee on Methods of Scoring**

R. A. BARACKMAN

The Subcommittee on Methods of Scoring Cake sent out a questionnaire in April, 1930, to ten persons having various interests relative to the baking of cakes. Three score cards were given in detail and criticisms of an ideal cake as given by a housewife were listed. The object of the questions which will be discussed later was to obtain a basis upon which to construct a card which would interpret the results obtained. Unfortunately, it was not emphasized that the card would be used for collaborative studies of cake flours. The commercial aspect, therefore, entered into the replies. However, it is of interest to note the answers from seven collaborators, although not all the questions were answered:

Five out of seven use a score card when judging cakes.

Four out of six were not satisfied with any of the three cards presented.

Three preferred a "numerical" score card, two an "adjective" score card and two preferred a combination of "numerical" and "adjective" cards.

Seven score cards were submitted which undoubtedly serve the purpose very well for which they were devised, but for obvious reasons, they will not be presented in detail. Three collaborators listed the properties of cakes under four headings.

1. Internal      2. External      3. Flavor      4. Odor

Others gave more detailed and less detailed general headings. The values assigned to general properties were at wide variance as was to be expected.

The "adjectives" assigned by collaborators are in part included in the definitions of terms. The following score card was developed to be used in connection with collaborative baking tests in which the flour will be the only variable.

#### SCORE CARD

Perfect Score	Points	
		<b>A. EXTERNAL</b>
15		1. Symmetry (Receded, rounded, excessive)
10		2. Volume
10		3. Crust
	3	Thickness
	3	Tenderness
	2	Sugariness
	2	Color
		<b>B. INTERNAL</b>
40		1. Texture
	15	Tenderness
	15	Silkiness
	10	Moisture
20		2. Grain
	5	Uniformity of cell structure
	5	Tunnels
	5	Size of cells
	5	Thickness of cell walls
		3. Color
	5	
	<hr/>	
	100	

#### EXPLANATION OF TERMS

- Symmetry:** The curvature of the upper crust of a cake will indicate the strength of a flour.
- Volume** is related to symmetry, but assuming equivalent conditions of air incorporation during creaming and beating and equivalent extent of leavening reaction, volume will vary with the strength of flour.
- Crust:** The thickness and tenderness of the crust as well as sugariness and color will in a large measure depend upon the abilities of the operator.
- Texture:** Tenderness is an indication that a flour will produce a crumb which is resiliant and will not crumble. A silky crumb is dependent upon the granulation of the flour. A moist crumb, not soggy or dry, indicates a desirable quality in a flour to retain moisture.

5. **Grain:** The uniformity of cell structure is related to the gluten quality of a flour. Tunnels indicate improper mixing. Size of cells and thickness of cell walls are a criterion of the ability of the flour gluten to stretch and to retain the structure upon baking out.
6. **Color** is of minor importance since most flours are used in cakes colored by other ingredients.

The above score card is very easily adaptable to commercial use. The opinion of collaborators was that the flavor of cakes should be weighted the same as internal appearance. By considering a perfect score of 200, flavor could receive 65 points, leaving 35 points for odor, icing and other properties of commercial interest.

### **Effect of Temperature on the Dough and Its Influence on the Standard Baking Test**

V. E. FISHER

In working with this problem we found that we could not study the influence of temperature on the dough without first making a study of creaming temperatures. So we divided our problem into two series of experiments, that of creaming temperatures and that of doughing temperatures.

**Creaming Temperatures:** We ran a series of cakes using creaming temperatures of from 50° F. to 90° F. making a 5° spread between each lot. We found that our most satisfactory results as to bulk of cream was between 70° F. and 80° F. Next we used this cream in cakes being careful to get the temperature of the dough as near 70° F. as possible. Our best cakes were from those creamed at 70° F. and 75° F. Therefore we went to work on creaming temperatures between 65° F. and 80° F. and as a result of considerable baking found our best cakes were obtained when creamed at 73° F., although larger cakes were obtained from a creaming temperature of from 75° F. to 76° F.

**Doughing Temperatures:** In order to determine the effect of the doughing temperature on the Standard Baking Test we used a range of dough temperatures from 55° F. to 90° F. By using the same method of experimenting that we did with creaming, we found that our best cakes were coming from doughs between 65° F. and 76° F. With this range established we made numerous bakings and from these concluded that our best cakes were from a dough temperature of 70° F. Also that between 70° F. and 73° F. the difference in the cakes was so small that it was not positive.

**Conclusion:** That when using the Standard Baking Test as it now stands, the proper temperature for creaming is 73° F. and 70° F. is most suitable for the dough.

**Report on Methods of Incorporating Ingredients and Their Effect  
on Standard Baking Tests**

L. H. BAILEY

Starting with the method of incorporating ingredients as given to the committee last year in their study of the Standard Baking Test for cake, the writer has studied about twenty-five variations in methods of incorporating ingredients.

The usual method is to cream fat, sugar, and dry milk at medium speed for ten minutes, soak the egg albumen in water, and sift the flour, cream of tartar, soda, and salt together, then add alternately and gradually the egg in water and dry ingredients, beating at low speed, for 2 minutes; total time 12 minutes.

One variation was made by dissolving both the milk and egg in water and adding alternately with the dry ingredients. Another was to add one-third of the flour to the fat and sugar after they had been creamed for 2 minutes at medium speed, and then add the rest of the flour and dry ingredients alternately with the milk and egg. Still another was to omit the cream of tartar and soda, until one-half minute before the mixing was completed. Other variations were (1) to add one-third of the flour with fat and sugar before creaming; (2) to stir egg with sugar, add all dry ingredients except fat and beat, then add fat one minute before stirring was completed.

Thus one variation after another was made, in each case there was a slight change from the other tests, either in the order in which the ingredients were added or in the length of time they were mixed, or the speed at which the mixing was done.

The various changes did not produce noticeably different results. The question then arose what difference is made by the order in which ingredients are added. To settle this point we put together all the ingredients at once and beat them thoroughly. The result was not altogether satisfactory on account of the large loss of gas from the batter before the cake went to the oven. This was remedied by omitting one of the leavening agents until the batter was mixed, then adding this remaining ingredient and stirring just enough to insure uniform distribution. It was shown by this procedure that satisfactory cakes could be made by adding all the ingredients (except one of the leavening agents) at the same time and mixing at high speed for 10 or 25 minutes, then adding the remaining leavening agent, stirring enough to secure even

distribution, then panning and baking. The results of these experiments are shown in the accompanying table.

More recently further tests have shown that good results can be obtained by beating for only 5 minutes, and medium speed may be substituted for high speed. This procedure may be used not only with the white cake formula furnished by the committee, but it may also be used in making some other types of cake, for example, pound cake and gold cake.

CAKE SCORE

Test	Maximum short circumference in inches	Height in mm. at 3 places	Springiness (10)	Grain (10)	Uniformity (10)	General appearance (10)
1	10.0	50-58-50	9.2	8.5	9.2	7.0
2	10.0	54-56-53	9.5	8.6	9.4	6.8
3	10.0	50-60-50	9.0	8.5	9.0	6.5
4	10.0	48-55-52	8.5	8.0	9.0	6.0
5	9.5	45-50-40	8.0	7.0	7.0	6.0
6	8.9	40-50-37	8.0	7.0	8.5	6.0
7	9.5	45-55-55	9.5	9.2	9.4	9.0
8	9.4	46-52-46	9.4	9.5	9.8	9.5
9	9.4	45-53-50	9.4	9.4	9.6	9.2
10	9.5	46-60-48	8.5	9.0	9.8	8.8
11	10.7	60-55-65	9.5	9.5	9.5	9.2
12	9.6	52-58-52	9.0	9.2	9.6	9.4
13	9.8	52-59-58	9.4	9.5	9.4	9.5
14	10.5	60-60-62	9.7	9.6	9.5	9.6
15	10.2	55-59-59	9.8	9.6	9.6	9.6
16	9.8	58-58-58	9.8	9.6	9.5	9.5
17	11.2	66-72-70	9.5	9.3	9.5	9.5
18	10.8	62-65-70	9.0	8.5	9.5	9.7
19	10.1	60-66-60	8.6	8.7	9.2	9.0
20	9.7	55-60-54	9.4	9.2	9.1	9.2
21	10.2	59-64-58	9.4	9.4	9.5	9.4
22	8.9	40-53-41	8.0	7.0	7.5	7.0
23	10.4	62-68-60	9.5	9.5	9.5	9.4
24	10.5	66-71-62	9.5	9.5	9.3	9.5
25	10.4	56-68-65	9.5	9.5	9.3	9.5
26	10.4	60-66-60	9.3	9.3	9.2	9.3
27	10.1	61-63-60	9.2	9.0	9.2	9.1
28	10.4	63-70-62	9.5	9.5	9.2	9.1
29	10.7	63-68-67	9.3	9.5	9.4	9.2
30	10.7	62-71-67	9.4	9.5	9.4	9.5

### Description of Methods of Mixing

In all cases 5 grams of dried egg white was soaked in 100 cc. of water for 2 hours, or longer, sometimes over night. In addition, 130 cc. of water was added to each cake.

1. Creamed fat, sugar and dry milk, 10 minutes at medium speed, added egg in water alternately with flour, cream of tartar, soda, and salt while stirring at low speed 2 minutes.

2. Creamed fat and sugar 10 minutes at medium speed. Dissolved milk in 130 cc. water and egg in 100 cc. water, united and added alternately with flour, soda, cream of tartar, and salt; low speed, 2 minutes.

3. Same as (2) only added  $\frac{1}{3}$  of flour to fat and sugar after they had been creamed for 2 minutes at medium speed. Continued creaming for 10 minutes. Then added remainder of flour, etc., with liquid ingredients.

4. Same as (3) only cream of tartar and soda were not added until  $\frac{1}{2}$  minute before mixing was completed.

5. Creamed fat, sugar, dry milk, and  $\frac{1}{3}$  of flour at low speed one minute, then at medium speed 9 minutes, then added egg dissolved in water alternately with  $\frac{2}{3}$  of the flour, etc., for 2 minutes at low speed.

6. Stirred egg in water with sugar, added all dry ingredients except fat and beat for 10 minutes at medium speed. Then added fat and beat 1 minute medium speed.

7. Beat egg in water, sugar, and cream of tartar to a foam 10 minutes at medium speed, added dry ingredients (except soda and fat) beat for 5 minutes at medium speed, added fat and beat for 5 minutes at medium speed, scraped, added soda, and beat for 1 minute.

8. Beat all ingredients except cream of tartar and soda for 5 minutes at medium speed, then added cream of tartar and soda and beat  $\frac{1}{2}$  minute at low speed.

9. Beat egg in water and cream of tartar to a foam 14 minutes, added dry ingredients except fat and soda, beat 1 minute, added fat and beat 5 minutes at medium speed, scraped, added soda, and beat 1 minute at low speed.

10. Beat all ingredients for 5 minutes at medium speed.

11. Beat all ingredients except cream of tartar and soda for 12 minutes at medium speed. Scrapped and added cream of tartar and soda at low speed for  $\frac{1}{2}$  minute.

12. Creamed fat and sugar for 10 minutes at medium speed. Dissolved milk in 130 cc. water and added to the egg in 100 cc. water, added this mixture alternately with flour and salt, beat for 3 minutes, scraped and added cream of tartar and soda and mixed for  $\frac{1}{2}$  minute at low speed.

13. Creamed fat and sugar for 10 minutes at medium speed, added egg in 230 cc. water gradually with flour, milk, and salt, mixed for 3 minutes; then scraped and added cream of tartar and soda at low speed, for  $\frac{1}{2}$  minute.

14. Creamed fat, sugar, and egg in 100 cc. water at medium speed for 5 minutes, and at high speed for 5 minutes, then added flour, milk, and salt alternately with 130 cc. water for 3 minutes; then scraped and added cream of tartar and soda and mixed  $\frac{1}{2}$  minute.
15. Creamed fat, sugar, and egg in 100 cc. water and  $\frac{1}{3}$  flour for 10 minutes at medium speed, then added  $\frac{2}{3}$  of flour, milk, and salt alternately with 130 cc. water for 2 minutes at low speed, then added cream of tartar and soda for  $\frac{1}{2}$  minute at low speed.
16. Creamed fat, sugar, milk, and 130 cc. water and  $\frac{1}{3}$  flour for 5 minutes at medium speed and for 5 minutes high speed, then added  $\frac{2}{3}$  flour, salt, and egg in 100 cc. water alternately for 2 minutes at low speed and 1 minute at medium speed.
17. Beat all ingredients except cream of tartar and soda at high speed for 12 minutes, then added cream of tartar and soda and beat at low speed for  $\frac{1}{2}$  minute.
18. Same as (17) only beat at high speed for 20 minutes.
19. Same as (1) only beat at high speed and then added soda and cream of tartar and beat at low speed for  $\frac{1}{2}$  minute.
20. Same as (17) only beat at high speed for 2 minutes after adding cream of tartar and soda.
21. Beat all ingredients except cream of tartar at high speed for 10 minutes.
22. Beat all ingredients including cream of tartar and soda for 10 minutes at high speed.
23. Beat all ingredients except cream of tartar for 15 minutes at high speed, then added cream of tartar at low speed for  $\frac{1}{2}$  minute.
24. Like (23) only beat for 20 minutes at high speed.
25. Like (23) only beat for 30 minutes at high speed.
26. Like (24) only used different flour.
27. Like (22) only used different flour.
28. Like (23) only used different flour.
29. Like (28) only beat for 20 minutes.
30. Like (28) only beat for 25 minutes.

**Testing Soft Wheat Flours for Uses Other Than Cake Making**

J. A. DUNN

There are two important outlets for soft wheat flour, in addition to that afforded by the cake industry. The pie industry, already of tremendous size and importance—and still growing; and the great biscuit and cracker industry which annually sells merchandise with a value in excess of \$350,000,000. This association might well interest itself in ascertaining just what type of flour is suited to each phase of these industries.

In the pie industry, it has already been shown that the shortening requirement is dependent on the strength of the flour as shown by the protein content. If we multiply the protein content by the factor ten we may obtain the number of pounds of shortening required per barrel of flour, to produce an average crust.

The soaking of pie crusts is one of the evils of the industry. The amount of soaking is inversely proportional to the shortening used. The average protein content of pie flour will approximate 9.5%. This may vary somewhat, depending upon the type of wheat and the locality.

The granulation of a pie flour is very important as it affects the shortening requirement. The amount of shortening necessary to produce a crust of standard tenderness, varies inversely with the granulation (size of flour particles). This is a point which has apparently been overlooked by the pie baker and the miller.

The mixing tolerance of a flour is also important. Some flours can be well mixed without toughening the crust, whereas others must be handled gently. Flours with a good mixing tolerance will be welcome in the pie industry.

Far too little is known, also, of the type of flour best suited to the needs of the biscuit and cracker industry. It would seem natural that a flour which will produce good crackers might not be well suited for sweet goods production. Yet many millers recommend their flour for both purposes.

A questionnaire, sent to about 70 millers who were supplying flour to the biscuit and cracker industry reveals the following facts:

All used either soft red winter or white wheats. The following states were represented: Missouri, Kansas, Nebraska, Illinois, Indiana, Ohio, Michigan, New York, Maryland, Washington, Idaho and Ontario.

The extraction varied from 50% to 100% with an average of 76%. The protein content ranged from about 7.5% to 10.5%. Approximately 90% of the flours were bleached and about 10% were unbleached. The ash content varied from 0.31% to 0.56%.

Quite a number of biscuit and cracker bakers use two flours in their cracker doughs. One flour is fairly strong and will probably average about 9.0% to 9.5%. The other is somewhat weaker and will average about 8.5%. The stronger flour is used in the sponge and the softer flour in the dough-up. Due to the fact that experimental soda crackers are difficult to make, most cracker plants use the cut-and-try method when each new crop comes on. New and old crop flours are usually blended during the fall months.

The sweet goods flours used by the industry are quite soft. The protein content will run from 7.4% to 8.2% on an average. It is possible to use stronger flours to good advantage, thereby cutting down on the eggs used, and increasing the sugar and shortening. In this manner, the cost of ingredients may be lowered.

In the experience of the writer, it is not practicable to use a shortometer, in trying to determine the sugar and shortening requirement of a flour. We have tried measuring the sugar requirement by measuring the effect of sugar content on the spread of the cookie. In this we were fairly successful.

As we have indicated in the case of pies, the granulation of the flour affects the shortening requirement. As the size of the flour particle gets smaller, the specific surface increases. We feel that the shortening requirement depends (among other things) upon the amount of surface to be covered. Hence one might expect that less shortening would be required with coarser flours. In such biscuits as Scotch Short Breads, this may be easily demonstrated.

At the present time, there is a marked tendency in the industry toward less eggs and lower costs. In fact, many sweet cookies contain no eggs at all. We feel that stronger flours can be used in such cases, and that the extra strength makes up for the lack of that structure provided by the eggs.

We have tried to summarize our knowledge of the types of flour used in the biscuit and cracker and pie industries. As we have tried to indicate, much remains to be done. Research in these fields would be very interesting and very remunerative. It is virgin soil.

### Viscosity and the Experimental Cake

EDWARD E. SMITH

Various flours were baked, using the method of the Committee on the Testing of Soft Wheat Cake and Biscuit Flours, as amended in 1929.

The viscosity of each sample was determined, using a Mac-Michael viscosimeter upon a suspension of 20 gm. of the flour in 100 ml water, after the addition of 5 cc. of normal lactic acid—the standard method of our laboratory.

The flours employed were patents and straights of widely varying quality; some of them milled in our mill, but most of them bought in the market or secured by our salesmen from the trade.

A detailed discussion of each of these flours would be unnecessary, even useless here—the results of this investigation can be most clearly portrayed by a brief tabulation of group characteristics, as follows:

Viscosities	Cake Volume	Cake Qualities
25°-30°	490-640	Poor to Excellent
31°-35°	475-660	Poor to Excellent
36°-40°	620-660	Good (2 flours only)
41°-45°	470-650	Poor to Excellent
46°-50°	560-700	Fair to excellent (3 only)
51°-55°	600-700	Fair to Excellent (2 only)
56°-60°	500-700	Poor to Excellent
61° up	490-640	Poor to Excellent

These results, while they might be changed somewhat by another year of study, bear out conclusions previously drawn by myself and by several other investigators as to the significance of viscosity in other fields of interest—the viscosity figure is entirely meaningless in predicting the quality of a white loaf cake baked according to the formula and method referred to above.

### Mixing Time and Its Effect on Results of Standard Cake Baking Test

G. L. ALEXANDER

The creaming and mixing time is an important factor in the cake baking test because of its effect on the inside structure of the cake. Insufficient time usually results in a coarse grained, harsh textured cake, scoring low in crumb color, although the cake volume may be greater than usual. Over-creaming and mixing usually has opposite effects. The time of creaming and mixing

is governed by the type of cake desired, the character of ingredients used, their temperature, and the method of agitation. In this report, discussion will be confined as much as possible to time alone, taking for granted the uniformity of the other factors. However, it is suggested that a standard flour, of which the cake value is known, should be baked with each series of checks between laboratories in order to offset differences in ingredients, mixers, and temperature control facilities.

In the last committee report, it was recommended that 2X granulated sugar be specified for the standard cake test. However, no change was made in the specified creaming time to correspond to this recommendation. Coarse granulated sugar, such as was used in working out the mixing method, requires much more creaming than does the 2X granulation. For several reasons it is desirable to make the creaming time as short as is consistent with satisfactory baking results, and the following procedure is recommended for test work:

Place sugar and shortening in mixer bowl and beat at low speed for one minute. Where the powdered milk is creamed with the sugar and shortening, an additional minute of mixing is advisable at this stage. Scrape sides of bowl and continue creaming at second speed for four more minutes.

With such a rich formula as we are using in our test method, some committee members have had difficulty in getting a sufficiently light and open grained cake to permit accurate scoring of grain and texture. It is therefore recommended that the batter mixing time be made as short as possible, especially at the higher speed of mixing, with the aim of producing a slightly more open grain. The following procedure works well, and is recommended:

To the creamed shortening and sugar, using low speed, add one-third of the sifted dry material; follow with one-half of the liquid, then another one-third of the dry material, then the rest of the liquid, and finally, the balance of the dry material. This will take about one and one-half minutes. Now scrape the sides of the bowl and beat at high speed for one minute.

The recommendations in this report are based on observation of the standard practice in commercial cake bakeries where machine mixing is used.

**The Water Tolerance of Soft Wheat Flours for Cake Baking**

C. B. KRESS

Judging from our experience in bread-making, the absorption of a flour should also be considered in making a cake test. Theoretically, a flour of low absorption should also be given less liquid in making a cake than one of higher absorption. An examination of various pastry flours that we have tested shows that the absorption varies from 54% to 58%, about 95% of the flours having an absorption of 54% to 56%. Since the absorption of pastry flours varies so little, this naturally reduces the importance of considering absorption in making a cake test.

To test this, I chose a flour of medium absorption, 56%, and made cakes using the standard formula furnished by the Chairman of the Cake Testing Committee, and also made cakes using 2%, and 4% more absorption, and 2% and 4% less absorption. This made a maximum difference of 8%, which surely should be sufficient to cover any difference in absorption that we will meet in cake flours. The effect on the cake was not remarkable. The standard absorption was slightly the best in each case, but even 4% more and 4% less is not sufficient to affect the test very seriously. Lowering the absorption makes the cake have a more bread-like texture, while increasing the absorption gives a softer, more velvety texture. The volume was not much affected.

**Suggestions Affecting the Cake Testing Formula**

1. That we use fresh egg white instead of powdered egg albumen. Cakes made from the albumen have a disagreeable taste, and are not serviceable in our contact with the baking trade and Sales Department.
2. That the amount of sugar be increased until it is equal or nearly so to the flour. This makes a much better cake, and is more in line with the best baking practice. It is also a more severe test on the flour and will better serve to distinguish between cake flours of varying quality.
3. That we attempt to make a cake of better texture, more silky. Fresh eggs will assist in this, and also creaming a portion of the flour into the shortening and sugar. Our proposed formula would then read:

Flour .....	225 gm.
Sugar .....	215 gm.
Shortening .....	75 gm.
Milk .....	165 cc.
Salt .....	3 gm.
Baking Powder .....	7 gm.
Egg White .....	120 cc.

Cream at low speed the shortening and 50 gm. of the flour and baking powder mixture; add  $\frac{1}{2}$  sugar; continue to cream. Then add 25 gm. of the flour and baking powder mixture, and cream; add remainder of the sugar and cream; then remainder of flour and milk alternately until incorporated. Mix on 2nd speed  $\frac{1}{2}$  minute. Then fold in beaten egg whites.

This process makes a cake of excellent texture, which will compare favorably with those made by bakers.

### Size and Shape of Pans and Their Effect Upon the Standard Baking Test

C. B. MCINTOSH

In all previous work on the Standard Baking Test for Cake and Biscuit Flours, a loaf cake has been the form of cake adopted for the experimental collaborative work. The question has been raised as to whether or not the results obtained with the size and shape pan adopted would be indicative of the results obtained by the same flour when baked in a pan of different size and shape.

The work recorded in this report was undertaken to determine the results obtained when various shapes and sizes of pans were used, when following the standard procedure and formula as given in the report of the committee last May at Kansas City.

There are such a great variety of shapes and sizes of pans in use in cake making that it would be impossible, or impractical to attempt to try all of them. For this investigation six different sizes of pans were selected as fairly representative of those used in commercial cake baking. Three were loaf cake pans and three were large cake pans. For convenience in reporting the results, we have designated them as follows:

- Standard Pan—Bottom, 3 in. by  $6\frac{3}{4}$  in.  
Top,  $3\frac{1}{2}$  in. by  $7\frac{1}{2}$  in.  
Depth,  $2\frac{3}{4}$  in.
- No. 1 Loaf Pan—Bottom, 3 in. by  $7\frac{1}{2}$  in.; top,  $3\frac{1}{2}$  in. by 8 in.; depth,  $2\frac{3}{4}$  in.
- No. 2 Loaf Pan—Bottom,  $2\frac{1}{2}$  in. by 6 in.; top,  $3\frac{1}{2}$  in. by  $6\frac{1}{2}$  in.; depth,  $2\frac{3}{4}$  in.
- No. 3 Layer Pan—Round 7 in. diameter; depth  $1\frac{1}{4}$  in.
- No. 4 Layer Pan—Rectangular, length 12 in.; width 6 in.; depth,  $1\frac{1}{4}$  in.
- No. 5 Layer Pan—Round,  $5\frac{1}{2}$  in. diameter; depth,  $1\frac{1}{2}$  in.

In order to make the results comparative, it was thought advisable to keep a constant ratio between the weight of the dough and the cubic volume of each size of pan. The cubic volume of each pan was calculated from the dimensions. The results were as follows:

Standard .....	857.2 cc.
No. 1 loaf.....	1115.4 cc.
No. 2 loaf.....	834.1 cc.
No. 3 layer.....	788.2 cc.
No. 4 layer.....	1474.8 cc.
No. 5 layer.....	638.3 cc.

In the standard test, 1200 cc. were used for 340 gm. of dough, or in the ratio of 0.3966 gm. of dough per cc. of pan volume. To maintain this ratio, the following amounts of dough were used in the other pans:

No. 1 loaf.....	442 gm.
No. 2 loaf.....	331 gm.
No. 3 layer.....	312 gm.
No. 4 layer.....	585 gm.
No. 5 layer.....	253 gm.

In carrying out these baking tests, the most recent standard formula and procedure was used. It will not be necessary to repeat them at this time, as the details can be found in the report of last year's committee. To eliminate any possible variables a batch four times the size of the standard batch was made, this giving sufficient dough for the six pans under consideration. The same flour was used in all tests, as well as the same lot of powdered milk, egg albumen, and granulated sugar. All six cakes were baked at one time and at the same temperature. The pans were all the same weight of metal and were lined with liners cut from the same grade of paper. Thus the only variables introduced were the size and shape of the pan and the scaling weight.

Two sets of tests were conducted, the only difference being the temperature of the oven at the time of baking. Series No. 1 was baked at 400°-5° F. and Series No. 2 at 375-80° F. After the cakes were baked they were allowed to cool for about a half an hour and then the volume was measured by means of the usual seed displacement method.

I will not go into detail in the results of each test in each series but will merely give the average of the results for each series.

Series No. 1 baked at 400-5° F. required the following average baking time for each size cake and gave the following average volume.

Standard, 30 min.....	743 cc.
No. 1 loaf, 33 min.....	945 cc.
No. 2 loaf, 31 min.....	722 cc.
No. 3 layer, 19 min.....	627 cc.
No. 4 layer, 22 min.....	1155 cc.
No. 5 layer, 20 min.....	491 cc.

Series No. 2 baked at 375-80° F. required the following average baking time for each size cake and gave the following average volume:

Standard, 40 min.....	700 cc.
No. 1 loaf, 40 min.....	938 cc.
No. 2 loaf, 40 min.....	680 cc.
No. 3 layer, 23 min.....	606 cc.
No. 4 layer, 25 min.....	1172 cc.
No. 5 layer, 23 min.....	512 cc.

To make a comparison of the volume of these cakes the foregoing results were calculated on the basis of cc. of cake per gram of dough used. The average results for Series 1 and 2 were as follows:

	Series 1	Series 2
Standard .....	2.185 cc.	2.059 cc.
No. 1 loaf.....	2.137 cc.	2.122 cc.
No. 2 loaf.....	2.159 cc.	2.056 cc.
No. 3 layer.....	2.009 cc.	1.942 cc.
No. 4 layer.....	2.060 cc.	2.003 cc.
No. 5 layer.....	1.962 cc.	2.023 cc.

Grouping these averages into the two general types of cake, loaf and layer cakes, we find the following results:

	Series 1	Series 2
Loaf cakes .....	2.160 cc.	2.079 cc.
Layer cakes .....	2.010 cc.	1.989 cc.

From these results we find that the layer cakes give a smaller volume per gram of dough than the loaf cakes. In Series No. 1 the layer cakes were but 93.05% of the volume of the loaf cake and in Series No. 2 they were 95.67% of the volume of the loaf cakes.

After the volume of the cakes were measured the cakes were cut and compared for appearance of texture and grain. We found that the same general characteristics were obtained regardless of the shape and size of the pan used.

From the results of this investigation, we felt justified in drawing the following conclusions:

First: That when the weight of dough used is in a constant ratio to the volume of the pan, the volumes of the baked cake will be in a practically constant ratio to the weight of dough used.

Second: That layer cakes will give a relatively constant smaller volume of cake per unit weight of dough.

Third: That the texture and grain of the cake will have the same general characteristics regardless of the size and shape of the pan used.

## REPORT OF THE COMMITTEE ON METHODS OF ANALYSIS

J. T. FLOHIL, Chairman

Pillsbury Flour Mills Co., Minneapolis, Minn.

(Read at Convention, May, 1930)

The Methods Committee appointed for the year 1929-30 consisted of J. A. LeClerc, F. A. Collatz, R. K. Durham, W. C. Meyer, A. E. Treloar, and J. T. Flohil. Two-thirds of this committee were new members, whereas F. A. Collatz and A. E. Treloar had previously served in the same capacity.

Former committees have diligently subjected the various conditions and manipulations regarding the cereal chemical routine to careful scrutiny and it may be well to enumerate briefly what has been done in the past in order that we may more readily comprehend the present state of our problems. Such an enumeration will also help to prevent us from overlooking what has already been accomplished and thus guard against unnecessary duplication of effort.

After perusing the previous reports, we find, in the case of the protein determination, that the following details have been made a subject of investigation: sampling, preparation of sample, size of charge, quantity of digestion acid, catalysts, time and conditions of digestion, precipitants for mercury, dilution, distillation, standard acids, methods of standardization and indicators.

In a similar way the procedure and equipment for the ash and moisture determination have been carefully studied and reported. However we will refrain from enumerating details in these cases, but we can truthfully say the ground has been well covered.

Realizing these facts, your committee, as the first phase of the year's work, set itself the task of surveying the accomplishments of the American cereal chemist regarding the accuracy of his routine work relating to the ash, moisture and protein tests. For this purpose a collaborative study of these tests was undertaken on a representative flour sample which was distributed among more than one hundred laboratories. In addition to this a lesser number of two sets of samples, composed of the same ground and unground wheat, were distributed for moisture and protein test. Unfortunately, a package of samples addressed to the secretary of one of our local sections failed to reach its destination and could not be replaced. Copies of the results of this work

have been supplied to the secretaries of the collaborative sections for distribution among reporting members.

If we now consider the averages obtained by the different sections in regard to the flour sample, we find in almost perfect agreement the protein as well as the moisture and ash results, and in this respect the sections present a united front. As to important individual deviations from the mean, we must admit that, like the poor, we shall always have them with us.

The flour sample referred to was analyzed by 105 collaborators, some of whom reported only protein results. At this time we wish to state that too many cereal chemists continue to report their protein and moisture results in two decimals and their findings on ash in three decimals. This practice does not serve any good purpose and should be discouraged. In this connection we refer to a recommendation made by the previous committee having the same object in view. In the case of the flour sample, the results have been changed to conform to this recommendation.

The average of the 105 reported protein results was 11.70%, which, in view of the large number collaborating, must be considered the correct percentage for all practical purposes at least. Of these 105 results, 89% deviated not more than 0.1% from the average either way; 37% were correct, 26% were above 0.1% and 22% were 0.1% under the average. In regard to the moisture results we find that out of 98 reporting 34% were exact and 77% varied only 0.1% or exactly coincided with the average. In regard to the ash results we find out of 99 reporting, 44% were exact and 83% within 0.01% or exactly hitting the average. Therefore, if we consider a maximum deviation of 0.1% in the case of protein and moisture, and 0.01% in the case of ash as being sufficiently accurate for practical purposes, then the percentages 85, 77 and 83 respectively represent the relative accuracy as regards protein, moisture and ash results on a representative flour sample.

The foregoing figures are encouraging, but let us now see how we fare with the results on the wheat sample, either primarily prepared by the distributor or ground by the individual collaborator himself.

After checking the analytical data obtained on the wheat samples we find that the accuracy on the prepared sample declined to 71% and on the individually ground sample to 62%. As regards the moisture content of the prepared sample, our accuracy is now only 44% and on the individually ground sample the figure has

declined to 37%. The decreasing accuracy in both cases was to some extent anticipated, but its importance is now brought more vividly to our attention.

These percentages are very unsatisfactory and clearly demonstrate that we are not able to maintain the same standard for both wheat and flour analysis. If we allow a deviation of 0.2% from the protein average in the case of the wheat ground by the individual analyst, our percentage accuracy becomes 84, which is comparable with 85 in the case of the flour sample where 0.1% deviation was allowed. 85 is of course a satisfactory percentage, but means that a spread of as much as 0.4% in protein between two laboratories will have to be tolerated. At least this is the logical conclusion to be drawn from the results that have been reported.

Similar conditions prevail with the moisture tests on the wheat samples. By allowing a deviation of 0.1% from the average we find on the ground sample an accuracy of 44% and on the unground sample this declines to 37%. Therefore, by permitting a deviation of 0.2% either way, these figures become 69 and 56, and even by extending the allowable deviation in the case of the unground wheat to 0.3%, our accuracy is only 66% which means that 34% of the reported results lie outside the range of 0.3% below and 0.3% above the average, or a total range of 0.6%. Even on the prepared sample, only 75% of the collaborators were within this range.

It is interesting to note that the 0.1% deviation from the average in moisture content was obtained by 77% of the collaborators in the case of flour, but only by 44% in the case of the already prepared wheat sample, from which we can of course infer but one thing, viz., that ground wheat offers much more difficulty than flour in making moisture determinations.

So much for this phase of our general routine work, and no matter how trite the subject may be, we face the fact that chemical work in the cereal laboratory revolves around the moisture, ash and protein tests. It is not because of lack of imagination or higher ambition that this committee has not branched out into the less commonplace analytical methods, but rather on account of the fact that as long as these standard tests are open for improvement in regard to accuracy as well as expediency, they rightly, by reason of their importance, should be given preference above all other tests.

Bearing this in mind, your committee in the second phase of its work has investigated the so-called direct ash method. This work was taken up at the instigation of the Pioneer Section of our association. The object of this collaborative work was not so much for the purpose of going into the details of the test itself, but rather to determine if results obtained with this method on different types of flour could be made to check with the official method. Our experience with this so-called "direct" method has been very favorable. In regard to its accuracy, as compared with the official method, it leaves little to be desired, and it is our opinion that this test is preferable to the official method in cases where platinum crucibles are not available, for the reason that porcelain or similar ware tends to change in weight during the incineration process, and only the weight of the flour and ash—and not that of the crucible itself—should enter into the computation of the final ash result. The goodly number of data obtained by both the official and direct methods on many varying types and grades of flour are here given for your consideration.

These comparative results leave very little to be desired and as the direct method is also a decided time-saver, there is little doubt that it will gradually win considerable favor among cereal chemists.

As the final phase of the Committee's work, a start has been made in an attempt to reconcile the Brown-Duvel moisture results with the official method. The importance of such an attempt is evident. The work outlined was based on a recommendation in the A.A.C.C. Book of Methods, viz., the increase of the final distillation temperature from 180° to 190° C. The committee was severely handicapped in this work on account of the difficulty in finding collaborators, who were in a position to run both Brown-Duvel and official moisture tests. The data, so far collected are by far too incomplete to be presented here and reference to this work is made for the sole purpose of indicating the desirability of continuing what has already been started. In this connection we wish to repeat what has been said earlier in this report, that only 66% of the moisture results obtained by the official method in the unground wheat samples were within a range of 0.6%. For this reason all important deviations between the Brown-Duvel and the official method cannot be laid to the imperfection of the former method and too great care cannot be taken in the prevention of moisture evaporation during and after the grinding process.

PROTEIN AND MOISTURE RESULTS ON GROUND AND UNGROUND SAMPLE  
OF THE SAME WHEAT  
A.A.C.C.

Name—	Ground Protein %	Moisture %	Unground Protein %	Moisture %
F. Lumsden	13.40	12.00	13.35	12.20
W. E. Glasgow	13.30	11.90	13.20	12.20
E. C. Paulsel	13.20	11.70	13.20	11.80
C. Ingman	13.30	11.90	13.30	12.15
F. W. Bliss	13.30	11.80	13.30	12.20
E. J. Sisser	13.40	11.80	13.40	12.40
B. Sullivan	13.30	11.90	13.10	12.10
E. Miller	13.20	12.10	13.15	12.30
F. H. Loomis	13.20	11.80	.....	.....
L. H. Patten	13.30	14.80*	.....	.....
P. Faisor	13.30	.....	.....	.....
O. C. Schermer	13.30	12.10	13.30	12.10
C. Briggs	13.26	11.50	13.00	.....
E. P. Jarvis	13.20	11.90	.....	.....
W. B. Young	13.25	.....	.....	.....
E. E. Palmer	13.30	12.20	13.10	12.40
Wm. Rabak	13.44	11.70	.....	.....
F. A. Collatz	13.20	11.80	13.10	12.30
H. A. Holmes	13.40	11.80	13.30	12.40
T. W. Sanford	13.30	11.90	13.30	12.40
W. O. Whitcomb	13.40	12.00	.....	.....
D. H. Ziel	13.20	11.80	13.00	12.20
R. L. Frye	13.20	11.95	.....	.....
C. O. Oppen	13.28	11.40	13.05	11.50
A. W. Meyer	13.50	12.00	.....	.....
F. Bartholemew	13.40	.....	13.40	.....
L. D. Whiting	13.13	11.91	12.81	12.13
V. E. Fischer	13.08	11.88	13.10	12.05
F. X. Nodler	13.16	11.60	13.02	11.96
R. R. Pitts	13.17	13.77	13.27	12.20
C. M. Thomas	13.30	11.78	13.10	11.80
F. Carr	13.09	12.20	13.20	12.40
E. Karback	13.00	.....	13.15	.....
C. F. Schnable	13.10	.....	13.06	.....
W. Green	13.11	11.65	.....	.....
G. L. Howard	13.20	11.50	12.96	12.20
O. E. Gooking	13.13	11.65	13.00	12.90
W. C. Meyer	13.15	12.08	13.25	12.20
R. J. Clark	12.88	11.77	.....	.....
A. R. Sasse	12.97	11.78	13.10	12.20
E. Tibbling	13.22	12.05	13.40	12.50
H. Weaver	13.09	11.53	13.06	12.10
R. K. Durham	13.12	11.82	13.06	12.38
O. E. Curtis	13.25	12.05	13.26	12.80
C. H. McIntosh	13.08	11.85	.....	.....
W. L. Heald	13.07	11.90	13.09	12.15
H. W. Winkler	13.18	12.13	13.18	12.61
N. Cunningham	13.20	11.46	13.29	12.03
C. J. Henry	13.42	11.84	13.28	12.26
F. Sticka	13.15	12.20	.....	.....
C. Moore	13.20	12.00	13.00	12.65
W. C. Richards	13.20	12.10	.....	.....

**PROTEIN AND MOISTURE RESULTS ON GROUND AND UNGROUND SAMPLE  
OF THE SAME WHEAT  
A.A.C.C.**

Name—	Ground Protein %	Moisture %	Unground Protein %	Moisture %
N. L. Gregory	13.40	11.70	13.20	11.80
C. G. Bald	13.26	12.00	.....	.....
M. D. Mize	13.22	11.51	13.30	10.73
W. H. Hanson	12.80	11.90	.....	.....
F. Woosley	13.34	11.70	13.16	11.26
R. S. Mather	13.08	11.77	13.03	11.98
H. H. Johnson	13.30	11.75	13.30	12.03
H. Baehr	13.30	11.92	13.22	12.27
A. A. Andre	13.20	11.90	13.15	12.26
R. M. Sanstedt	13.25	11.75	13.20	12.70
C. H. Hansen	13.04	11.30	13.04	12.07
J. Montzheimer	13.60	11.90	13.20	12.10
C. R. Gwin	13.00	12.70	.....	.....
F. W. Albro	13.20	11.90	13.15	12.30
T. F. James	13.40	12.00	13.17	10.90
Chas. Corder	12.92	11.72	13.01	12.50
W. L. Haley	13.17	11.50	12.96	13.00
O. Shaer	13.40	12.53	.....	.....
E. P. Walker	13.16	11.85	13.00	12.45
J. W. Clulow	12.87	11.58	.....	.....
H. L. Knisley	13.07	12.08	.....	.....
F. Leonard	.....	.....	12.75	12.32
O. W. Walker	.....	.....	13.36	11.80
E. Teiler	.....	.....	13.00	11.50
C. E. Mangels	.....	.....	13.20	12.40
A. D. Wilhoit	.....	.....	13.40	12.15
C. C. Fifeld	.....	.....	13.15	12.10
G. R. Stadler	.....	.....	13.10	11.06
A. L. Lancaster	.....	.....	13.13	12.50
S. G. Cobble	.....	.....	13.06	11.75
C. F. Davis	.....	.....	13.00	12.20
L. E. Leatherock	.....	.....	13.27	11.70
R. E. Lorimor	.....	.....	12.91	11.93
C. M. Murphy	.....	.....	13.00	12.11
L. H. McLaren	.....	.....	12.93	12.10
R. T. Holmsted	.....	.....	13.26	.....
R. B. Potts	.....	.....	13.22	11.80
M. C. Ross	.....	.....	13.08	12.00
C. S. Sullivan	.....	.....	13.00	12.10
J. Schlesinger	.....	.....	13.25	12.47
J. L. Spalding	.....	.....	12.72	12.15
A. A. Towner	.....	.....	13.30	12.00
B. H. Redman	.....	.....	12.85	12.25
G. H. Moran	.....	.....	13.00	.....
R. H. Marts	.....	.....	12.53	12.25

	Protein Ground	Moisture Wheat	Protein Unground	Moisture Wheat
High	13.60%	14.80%	13.40%	13.00%
Low	12.80	11.30	12.72	10.73
Average	13.21	11.85	13.13	12.13

\*Omitted from Average.

PROTEIN, MOISTURE, AND ASH RESULTS ON COLLABORATIVE SAMPLE NO. 3  
A.A.C.C.

Name	Protein %	Moisture %	Ash %
<b>Northwestern Section</b>			
Bliss	11.70	11.40	.54
Lumsden	11.80	11.60	.54
Young	11.70	....	...
Benson	11.90	11.50	.545
Norman	11.70	11.60	...
Glasgow	11.60	11.50	.53
Wilhoit	11.80	11.10	.55
Sullivan	11.80	11.40	.54
Ingman	11.70	11.40	.54
Palmer	11.90	11.10	.56
Whitacre	11.80	11.40	.55
Paulsel	11.70	11.30	.54
Sanford	11.70	11.50	.53
Mayer	11.70	11.00	.555
McGuire	11.80	11.50	.52
Rabak	11.50	11.30	.55
Holmes	11.80	11.50	.545
Average	11.74	11.38	.5423
<b>Pacific N. W. Section</b>			
Albro	11.70	11.50	.55
Chulow	11.75	11.20	.61
DeHaan	11.80	11.60	.58
Drumheller	11.70	11.40	.53
Gwin	11.60	11.40	.57
Haley	11.80	11.40	.54
James	11.80	11.10	.54
Leonard	11.60	11.50	.54
Montzheimer	12.00	11.30	.58
Moran	11.70	....	...
Redman	11.70	11.50	.55
Skaer	11.50	11.30	.56
Walker (E.)	11.60	11.50	.54
Walker (O. W.)	11.80	11.40	.55
Whitcomb	11.80	11.50	.54
Tuter	11.80	12.00	.54
Knisely	11.70	11.50	.47
Cloidt	11.70	11.40	...
Average	11.72	11.44	.555
<b>St. Louis &amp; Central States Section</b>			
Whiting	11.70	11.40	.55
Oppen	11.40	11.00	.55
Pitts	11.70	11.40	.54
Frye	11.70	11.40	.54
Flick	11.70	11.40	.55
Earlenbaugh	11.30	11.30	.53
Van Scyck	11.80	11.50	.55
Fisher	11.70	11.40	.55
Hagan	11.70	11.10	.54
Winkler	11.80	11.50	.54
Ulrey	11.40	11.60	.55
Gustafson	11.80	11.40	.54
Thomas	11.60	11.40	.55
Uphouse	11.70	11.20	.54
Average	11.70	11.37	.544

**PROTEIN, MOISTURE, AND ASH RESULTS ON COLLABORATIVE SAMPLE No. 3  
A.A.C.C.**

Name	Protein %	Moisture %	Ash %
<b>Pioneer Section</b>			
Baehr	11.60	11.40	.54
Clark	11.40	11.40	.55
Davis	11.70	11.50	.55
Heald	11.80	11.50	.56
Lentz	11.50	11.50	.55
Lorimer	11.60	11.40	.54
Murphy	11.60	11.40	.55
Leatherock	11.60	11.30	.55
Potts	11.50	11.50	.55
Ross	11.70	11.50	.55
Schlesinger	11.70	11.40	.56
Sullivan	11.60	11.50	.56
Swanson	11.60	.....	.55
Tibbling	11.80	11.50	.54
Towner	11.60	11.50	.55
Van Scoyk	11.80	11.50	.54
Weins	11.60	11.60	.55
Average	11.62	11.47	.55
<b>Kansas City Section</b>			
Schnable	11.80	.....	...
Karback	11.60	.....	...
Howard	11.70	11.50	.55
Durham	11.70	11.30	.56
Gookins	11.70	11.50	.54
Sasse	11.60	11.30	.55
Green	11.60	11.40	.56
Tibbling	11.70	11.40	.55
Clark	11.90	11.40	.55
Curtis	11.80	11.40	.55
Weaver	11.70	11.40	.55
Carr	11.70	11.60	.54
MacIntosh	11.80	11.50	.55
Meyer	11.70	11.40	.55
Heald	11.90	11.50	.56
Average	11.72	11.42	.55
<b>Niagara Frontier Section</b>			
Tucker	11.60	11.30	.55
Buzzelle	11.70	11.50	.55
Randall	11.70	11.30	.55
Richards	11.60	11.70	.55
Struve	11.90	11.20	.55
Flash	11.90	11.10	.55
Gregory	11.80	11.10	.56
Bald	11.70	11.50	.56
Henry	11.80	11.40	.55
Average	11.74	11.34	.5522

**PROTEIN, MOISTURE, AND ASH RESULTS ON COLLABORATIVE SAMPLE NO. 3  
A.A.C.C.**

Name	Protein %	% Moisture	Ash %
Nebraska Section			
Baehr	11.60	11.50	.55
Larson	11.80	....	...
Lancaster	11.70	11.50	.54
Summerville	11.60	....	...
Gottschalk	11.60	10.90	.55
Johnson	11.70	11.20	.55
Holt	11.70	11.20	.53
Earlenbaugh	11.30	11.30	.53
Mather	11.70	11.40	.56
Mize	11.70	11.30	.54
Hanson, W. H.	11.80	11.40	.55
Hansen, C. H.	11.65	11.40	.55
Andre	11.70	11.40	.53
Blish	11.80	11.30	.59
Cramer	11.80	11.40	...
Average	11.68	11.31	.55
TOTAL AVERAGE	11.70	11.39	.549
MAXIMUM	12.00	12.00	.61
MINIMUM	11.30	10.90	.47

**DIRECT AND INDIRECT ASH RESULTS  
Results Reported by Dr. Collatz**

DIRECT AND INDIRECT ASH RESULTS	Indirect Ash Results	Direct Ash Results
1	.48	.48
1	.48	.48
1	.48	.48
1	.48	.48
2	.42	.41
2	.42	.42
2	.42	.42
3	.42	.41
3	.42	.42
3	.42	.42
4	.705	.71
5	1.345	1.34
6	.795	.795
7	1.79	1.81
8	1.62	1.635
9	.405	.405
10	1.155	1.165
11	.685	.685
12	.51	.52
13	.44	.44
14	.415	.41
15	.395	.375
16	.50	.505
17	.54	.54
18	1.94	1.93
19	.375	.37
20	1.10	1.09
21	1.10	1.10
22	1.575	1.575

23	.45	.45
24	.415	.42
25	.475	.48
26	.455	.455
27	.45	.45
28	.445	.445
29	.45	.445
30	.45	.45
<hr/>		<hr/>
(Average)	.687	.6867

## Results Reported by Mr. Flohil

1	Southwestern	.456	.460
2	Southwestern	.418	.416
3a	So. W. & Hd. Wtr.	.536	.532
3b	So. W. & Hd. Wtr.	.524	.528
4	So. W. & Hd. Wtr.	.474	.478
5	Soft Winter	.368	.372
6	Soft Winter	.490	.492
7	Hard Winter	.470	.470
8	Spring and Hd. Winter	.444	.446
9	Spring and Hd. Winter	.434	.430
9	Spring and Hd. Winter	.426	.428
10	Spring and Hd. Winter	.454	.458
11	Spring and Hd. Winter	.444	.444
12	Spring and Hd. Winter	.442	.444
13a	Spring and Hd. Winter	.550	.554
13b	Spring and Hd. Winter	.550	.552
14	Spring and Hd. Winter	.548	.544
15	Spring and Hd. Winter	.764	.768
16a	Spring and Hd. Winter	.790	.792
16b	Spring and Hd. Winter	.796	.794
16c	Spring and Hd. Winter	.792	.790
17	Spring	.480	.478
18	Spring	.466	.468
19	Spring	.484	.482
20	Spring	.480	.482
21	Semolina	.650	.648
22	Rye	.890	.888
23	Rye	.724	.722
24	Rye	2.242	2.280
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		.6064	.6082

## Results Reported by Mr. W. E. Meyer

1	Montana Patent	.392	.396
2	Montana Patent	.395	.393
3	Montana Patent	.393	.395
1	Utah Patent	.384	.381
2	Utah Patent	.383	.381
3	Utah Patent	.387	.387
1	Pacific Coast, 100%	.415	.408
2	Pacific Coast	.41	.412
3	Pacific Coast, 100%	.42	.41
1	Clear	.728	.725
2	Clear	.737	.728
3	Clear	.734	.735
1	Low Grade	.944	.943
2	Low Grade	.956	.956
1	Blue Stem Patent	.380	.375
2	Blue Stem Patent	.385	.380
3	Blue Stem Patent	.380	.377

1	Kansas, 100%	.443	.445
2	Kansas, 100%	.440	.443
3	Kansas, 100%	.444	.444
1	Clear	.595	.593
2	Clear	.598	.594
3	Clear	.595	.596
1	Low Grade	.808	.811
2	Low Grade	.81	.804
3	Low Grade	.814	.808
1	Nebraska, 97%	.425	.42
2	Nebraska, 97%	.426	.425
3	Nebraska, 97%	.427	.428
1	Clear	.609	.607
2	Clear	.613	.608
3	Clear	.610	.611
1	Low Grade	.978	.971
2	Low Grade	.984	.985
3	Low Grade	.984	.984
		<hr/>	<hr/>
		.5836	.5816

**Results Reported by Mr. R. K. Durham**

Hd. Winter Flour	.440	.433	.440	.440
Hd. Winter Flour	.396	.400	.403	.400
Spg. Wheat Flour	.490	.483	.493	.493
Soft Flour—Phosphated	.913	.896	.890	.900
Hd. Winter Clear	.613	.613	.620	.616
Whole Wheat Meal	2.010	2.000	2.016	2.016
Hd. Winter Clear	.613	.606	.613	.610
Soft Wheat Clear	.506	.500	.510	.510
Hd. Winter Flour	.410	.413	.403	.406
Hd. Winter Flour	.413	.416	.406	.406
Hd. Winter Flour	.460	.443	.450	.453
Hd. Winter Flour	.493	.483	.486	.486
Hd. Winter Flour	.460	.450	.463	.466
Soft Wheat Flour	.390*	.390*	.393*	.390*
		<hr/>	<hr/>	
		.6122		.6134

**Results Reported by Dr. J. A. LeClerc**

1	.737	.723	.713	.704
2	.407	.413	.380	.390
3	.487	.473	.457	.460
	.54		.517	
Averages	.5400		.517	
	.5836		.5816	
	.687		.6867	
	.6122		.6134	
	.6064		.6082	
	<hr/>		<hr/>	
	.6058		.6013	

**Conclusions**

From the foregoing it may be said:

- (1) That our accuracy on a representative flour sample in regard to the protein, ash and moisture test is relatively satisfactory.

- (2) That the degree of accuracy in the determination of protein and moisture in a ready ground wheat sample is considerably less than that of a flour sample.
- (3) That the protein results in the individually prepared wheat sample reach the accuracy of that obtained on a flour sample only when the allowed deviation from the average is increased from 0.1 to 0.2% and in regard to moisture from 0.1 to 0.3%.
- (4) That this decreased accuracy is apparently the result of differences in evaporation during and after the grinding process, and the relative heterogeneity of the sample, as determined by its fineness.
- (5) That the degree of accuracy in the moisture results depends to even a greater extent than in the case of protein on the conditions relative to evaporation during and after the grinding process.
- (6) That the study of the direct ash method deserves further consideration as a result of the favorable comparison with the official method.
- (7) That further comparative study of the Brown-Duvel and official moisture method is desirable and that in comparing Brown-Duvel and official moisture results, the latter cannot be considered as a reliable standard for the former, until the official method as applied to wheat has been perfected.

#### A STATISTICAL ANALYSIS OF THE DATA COMPILED BY THE COMMITTEE ON METHODS OF ANALYSIS

ALAN E. TRELOAR

University of Minnesota, Minneapolis, Minn.

##### **1. Variability of the Protein and Moisture Determinations on Wheat**

In the absence of strict precautions being taken to control (as far as possible) the moisture content of the samples employed for the protein and moisture determination, any comparison made of the average yields computed from the results of the individual collaborating analysts must take into consideration at least two operative variables, (a) the true moisture content of the samples, and (b) the physical character of the meals from the various grinding systems employed. Since full concordance in the determination of

moisture has not as yet been reached by cereal chemists, it does not appear possible to differentiate between the influence of the above variables in the data under consideration. It would also be entirely unreasonable to assume that the moisture contents re-

TABLE I  
AVERAGE YIELDS AND DIFFERENCES FOR PROTEIN AND MOISTURE DETERMINATIONS  
ON GROUND AND UNGROUND SAMPLES OF WHEAT

	Protein	Moisture
Ground ( $\bar{x}$ )	13.2236 $\pm$ .0118	11.8612 $\pm$ .0329
Unground ( $\bar{y}$ )	13.1572 $\pm$ .0120	12.1730 $\pm$ .0403
Difference ( $\bar{x} - \bar{y}$ )	+0.0664 $\pm$ .0117	-0.3127 $\pm$ .0476
Diff./P.E. Diff.	5.69	6.57

ported by the analysts were sufficiently free from error to permit of correction of the protein contents to a uniform moisture basis. Accordingly the constants derived from these data must be interpreted with caution.

Table 1 presents the average values for protein and moisture determinations by 53 and 49 collaborators respectively upon samples of wheat received (a) ready ground and (b) to be ground in the collaborating laboratory. These averages indicate that the analysts have reported a significantly greater percentage of protein in the meal prepared by the Committee than in the wheat ground by themselves. The chances are exceedingly remote that this difference in the averages could have arisen simply through random sampling. It may, however, be due, entirely or in part, to the long grinding with consequent increased dessication sustained by the large sample prepared by the Committee. Thus the average moisture content reported from the unground sample is slightly over 0.3% greater than that from the ground sample.

The variability of the analyses in each series has been measured in terms of the standard deviation ( $\sigma$ ). It is interesting to note from these calculations, reported in Table 2, that while the variability of the collaborators' findings for both moisture and protein determinations is greater for the sample ground in their own laboratories, it cannot be demonstrated that the difference is significant, in so much as the ratio of the difference to its probable error is considerably less than 3 in each case.

It is of interest to compare the coefficients of variation for moisture and protein determinations with those already shown by Treloar and Harris<sup>1</sup>.

<sup>1</sup> Treloar, Alan E., and Harris, J. Arthur. Criteria of the validity of analytical methods used by cereal chemists. Cereal Chem. 5:333-351 (1928).

In the present series the coefficients of variation are as follows:

	Protein	Moisture
Ground Sample .....	0.96%	2.88%
Unground Sample .....	0.98%	3.43%

whereas the above authors obtained values of approximately 1% for protein and approximately 1.5% for moisture. Thus, while the variability of the protein determination is reasonably concordant with previous experience, the variability of the moisture determination shown herein has increased rather markedly above that ob-

TABLE II

STANDARD DEVIATIONS WITH DIFFERENCES FOR PROTEIN AND MOISTURE DETERMINATIONS ON GROUND AND UNGROUND SAMPLES OF WHEAT

	Protein	Moisture
Ground ( $\sigma_x$ )	.1270±.0083	.3415±.0233
Unground ( $\sigma_y$ )	.1291±.0085	.4177±.0285
Difference ( $\sigma_x - \sigma_y$ )	-.0021±.0168	-.0762±.0367

tained previously for the work of 51 analysts (1927 Report). This increase in the variability of analyses for moisture content of a sample of prepared wheat meal must be attributed to either or both of two factors, viz. (a) a lack of uniformity in the sample supplied, or (b) a decreased precision in moisture analyses in the current year's work. The entire problem of the variability of moisture determinations on the same sample by collaborators might very profitably be subjected to critical examination in a study similar to that devoted to the protein determination by the 1928-1929 Committee on Methods of Analysis.<sup>2</sup>

## 2. The Significance of Differences Between Sections of the Association in Their Reports Upon Protein, Moisture and Ash

The findings of collaborators within the separate local sections of this Association in chemical analyses should differ only in a manner attributable to chance from the average of the section involved or from the average of the Association as a whole. No significant differences should exist between the average values for the same determination reported by sections as a group. It has seemed desirable to study this point in connection with the present reports

<sup>2</sup> Treloar, Alan E. A statistical study of collaborative protein determinations. Cereal Chem. 6:429-453 (1929).

on flour sample number 3, involving analyses by the various sections for protein, moisture and ash. Pearson's criterion<sup>3</sup> of the significance of the deviation of averages of sub-samples from that of the entire sample has been applied, and the results are presented in Table 3. It seems logical to conclude from these constants that

TABLE III

PEARSON (1906) CRITERIA OF THE DEVIATION OF SECTIONAL AVERAGES FOR PROTEIN,  
MOISTURE AND ASH IN FLOUR SAMPLE NO. 3, FROM THE GENERAL AVERAGE

Section	Sectional Average (m)	Sectional Stand. Dev.	(m-M)	$\frac{m-M}{P.E. (m-M)}$
<b>Protein</b>				
General Average (M) = 11.6962			Standard Deviation = .1221	
Northwest	11.7412	.0974	+ .0450	3.74
Pacific N. W.	11.7250	.1083	+ .0288	2.37
St. Louis and Central States	11.6429	.1545	- .0533	4.38
Pioneer	11.6294	.1072	- .0668	5.62
Kansas City	11.7267	.0928	+ .0305	2.49
Niagara Front.	11.7444	.1066	+ .0483	4.14
Nebraska	11.6767	.0387	- .0195	1.59
<b>Moisture</b>				
General Average (M) = 11.3969			Standard Deviation = .1574	
Northwest	11.3813	.1740	- .0157	.04
Pacific N. W.	11.4412	.1849	+ .0442	1.08
St. Louis and Cent. States	11.3571	.1545	- .0398	.96
Pioneer	11.4625	.0696	+ .0656	1.60
Kansas City	11.4308	.0822	+ .0338	.82
Niagara Front.	11.3444	.1892	- .0525	1.24
Nebraska	11.3231	.1527	- .0739	1.79
<b>Ash</b>				
General Average (M) = .5478			Standard Deviation = .0147	
Northwest	.5423	.0100	- .0054	.43
Pacific N. W.	.5494	.0288	+ .0014	.11
St. Louis and Cent. States	.5443	.0062	- .0035	.27
Pioneer	.5494	.0064	+ .0017	.13
Kansas City	.5508	.0062	+ .0030	.23
Niagara Front.	.5522	.0133	+ .0045	.34
Nebraska	.5475	.0159	- .0003	.02

the different sections obtained on the whole significantly different average yields for protein. They did not, however, differ in like manner in the moisture and ash determinations. While the average protein reports of the different sections show less variation than the average moisture determinations, the consistency *within* the sections for the protein determination is so much greater than for moisture that the sections become differentiated with regard to the

<sup>3</sup> Pearson, Karl. Note on the significant or non-significant character of a sub-sample drawn from a sample. Biometrika 5:181-183 (1906).

former but not with regard to the latter. The differences between sections for the protein determinations would probably be considered unimportant for all except the Pioneer section, which is distinctly low in its findings.

It is worthy of note that in all probability the reports of the individual collaborators in this particular work represent averages of two or more determinations. On this account the variability found may not be accepted in any sense as measuring that to be expected in single determinations.

### 3. Comparison of the Results from the Direct and Indirect Methods of Determining Ash

Two factors of variability affecting the final results must be considered in any chemical determination on the cereals. First, there is the intrinsic variability of the sample, and second, the variation attributable to the method employed (i.e. in the hands of any one analyst). If two methods of making the same determination are applied to each of a series of flours, the results of that method which has the greater variation within itself may be expected to be more highly variable than those of the other method, since the flours are the same in the two cases. The direct and indirect methods of determining ash in flour may be roughly compared in the available data by this type of analysis. The significance of differences in the standard deviations may not, however, be determined since the probable errors of the differences involve the range of flours used as well as the variability of each method.

For the 30 samples analyzed by F. A. Collatz, embracing 37 determinations, the following constants are available.

	Indirect	Direct
Mean .....	.6869	.6869
Standard Deviation .....	$.4347 \pm .0341$	$.4367 \pm .0342$

For all intents and purposes the data of Dr. Collatz indicate that the two methods are equally valuable in his hands.

For the 29 determinations made by J. T. Flohil in comparing the calcium acetate, official and direct methods of determining ash we have:

	Calcium acetate	Official	Direct
Mean .....	.5998	.6064	.6083
Standard Deviation .....	$.3235 \pm .0286$	$.3383 \pm .0300$	$.3443 \pm .0305$

The variability obtained for the flours analyzed by these three methods is such that no significant difference is demonstrable between the means or standard deviations of any pair considered.

Omitting the series of determinations on low grade flour in which one direct ash determination was spoiled by sticking of the residue to the porcelain crucible, the means and standard deviations obtained for the 11 remaining flour samples analyzed by W. E. Meyer in a comparison of three different types of crucibles are as follows:

	Indirect	Direct
Porcelain Crucibles		
Mean .....	.5597	.5575
Standard Deviation .....	.1937 ± .0279	.1934 ± .0278
Vitreosil Crucibles		
Mean .....	.5619	.5594
Standard Deviation .....	.1958 ± .0282	.1949 ± .0280
Platinum Crucibles		
Mean .....	.5625	.5614
Standard Deviation .....	.1952 ± .0281	.1954 ± .0281

Quite apparently there are no differences demonstrable between either the direct or the indirect methods in this series, nor do the results differ significantly when the three different types of crucibles are employed. This may, however, be in large part due to the very small number of flours analyzed, and the wide range of ash contents of the flours as compared to the variabilities of the methods themselves.

The duplicate results reported by R. K. Durham readily lend themselves to a more direct comparison of the methods themselves, by analysing the consistency of the replicated determinations. Thus the average difference between duplicates for the indirect method is .007 gm. whereas the average difference between two analyses by the direct method is .002 gm. There is a very striking difference between the average ranges of the duplicate determinations obtained in each case. If these fourteen pairs of duplicates may be considered as an adequate sample for such a comparison, it is apparent that the variability of duplicate results obtained by the indirect method of determining ash in Mr. Durham's hands is over three times as great as that obtained when he employs the direct method. These latter results certainly indicate that a comparison of the two methods of wider scope along the lines reported by Mr. Durham might profitably be undertaken.

## REPORT OF COMMITTEE ON FLOUR SPECIFICATIONS

F. A. COLLATZ, Chairman

General Mills, Inc., Minneapolis

(Read at Convention, May, 1930)

In a previous report of this committee Brooke (1929) has summarized the literature pertaining to the acidity of wheat and flour with special reference to methods of extraction with alcohol and its subsequent determination by titration. Collatz (1929) has traced the development of the A. O. A. C. method as used in this country and has given a comparison of acidity results in flour determined by the Greek Method (alcohol extraction) and the A. O. A. C. method. Fifield and Bailey (1929) have reported on changes in acidity in flour, during storage, by both methods. Bailey (1930) in a report to the A. O. A. C. summarizes the literature with respect to the different methods of determining acidity.

White (1909), and Swanson, Willard and Fitz (1915), have noted that acidity in flour, as determined by water extraction methods, closely follows the grade of flour. Ladd (1909) shows by water extraction of flour, that increase in temperature of extraction increased the degree of acidity.

Sixteen freshly milled flours and four aged samples were distributed to each of five collaborators during the year for immediate ash and acidity determinations. The acidity was determined both by the A. O. A. C. and the Greek method. An inspection of Table I indicates very close agreement on most samples among the various collaborators on both methods, the average coefficient of variation being 14.51% for the A. O. A. C. and 12.84% for the Greek method. This would seem to indicate slightly better checking by the latter method.

The data obtained using the A. O. A. C. method confirms previous reports in that the acidities expressed as lactic acid closely parallel the ash content. Submitting this data to mathematical treatment, corrections can be applied so that a straight line relationship is found to exist between ash and water-extractable acidity,—this includes the four aged samples (17-20). The coefficient of correlation between ash and water extractable acidity is very high, and by using the average obtained by the five collaborators a value of  $r=0.930$  is obtained. Where results of one individual are used the coefficient of correlation is still higher as found by Markley on 52 samples of freshly milled flour. These data indicate that acidity as determined by the A. O. A. C. method appears to be

TABLE I.  
COMPARISON OF ACIDITIES AS DETERMINED BY THE A.O.A.C. AND GREEK METHOD

SAMPLE	Average Ash %	Acidity as Determined by A.O.A.C. Method %					Acidity as Determined by Greek Method %					
		No. 1*	No. 2	No. 3	No. 4	No. 5	Average	No. 1	No. 2	No. 3	No. 4	No. 5
1. Durum Fancy Patent	.61	.150	.160	.128	.160	.133	.1462	.032	.049	.044	.038	.0424
2. Spring Clear	.78	.200	.230	.209	.241	.200	.2160	.048	.066	.057	.058	.0584
3. Durum Clear	1.08	.260	.275	.244	.282	.240	.2602	.055	.078	.068	.069	.0670
4. Durum Clear	.93	.230	.260	.215	.256	.214	.2350	.058	.076	.064	.075	.0676
5. Kansas First Clear	.70	.215	.225	.200	...	.200	.2100	.052	.060	.059	...	.066
6. Spring Clear	.75	.250	.250	.212	...	.230	.2355	.071	.075	.081	...	.079
7. Spring Second Clear	1.08	.420	.440	.352	...	.350	.3905	.113	.115	.127	...	.117
8. Spring Straight	.47	.145	.140	.144	...	.150	.1447	.038	.045	.049	...	.055
9. Spring Patent	.41	.110	.120	.116	.114	.121	.1162	.028	.035	.034	.037	.042
10. Spring Straight	.52	.140	.145	.149	.147	.151	.1464	.033	.045	.044	.040	.0420
11. Spring Clear	.69	.195	.190	.202	.206	.180	.1946	.034	.055	.050	.043	.052
12. Spring Second Clear	1.17	.305	.310	.296	.340	.294	.3090	.036	.065	.054	.044	.0514
13. Durum Patent	.62	.145	.170	.145	.152	.147	.1520	.028	.032	.046	.033	.0340
14. Durum Clear	1.55	.340	.350	.364	.348	.360	.3524	.053	.065	.064	.053	.0606
15. Spring Clear	.79	.220	.230	.210	.202	.210	.2144	.044	.060	.064	.050	.0540
16. Spring Second Clear	1.77	.410	.450	.429	.398	.410	.4194	.067	.090	.081	.062	.0772
17. Spring Patent	.42	.125	.110	.120	.124	.136	.1230	.043	.050	.059	.046	.0532
18. Durum Clear	1.01	.355	.320	.352	.365	.320	.3424	.260	.250	.254	.252	.2500
19. Spring Second Clear	1.00	.375	.360	.376	.395	.360	.3732	.162	.205	.200	.198	.1950
20. Pat. Spcl.	.57	.205	.180	.212	.199	.200	.1992	.049	.060	.066	.054	.060

\* Indicates Number of Collaborator.

nothing more or less than a function of ash content or grade of flour.

In a general way the acidity, as determined by the Greek or alcohol extraction method, increases as the ash content of the flour increases but not in such a regular manner as described above for the A. O. A. C. method. Individual samples depart quite markedly in this respect as will be noted from the data given in Table I. The four aged samples (17-20) are conspicuously high in acidity with relation to the ash content of the flour in comparison with the A. O. A. C. results. The coefficient of correlation between the acidity as determined by the Greek method and the ash content in the instance of freshly milled flours, (Numbers 1-16), is  $r=0.53$ , when averages of the five collaborators are used. Markley, using the Greek method, shows a higher coefficient of correlation on 52 samples than those reported by the committee.

### **Summary and Conclusions**

The data reported by this committee to the Association indicates that the A. O. A. C. method of determining acidity gives results paralleling the ash content of the flour. This acidity is the sum of acid-reacting materials present in the flour plus acid-reacting substances produced by enzymic and bacterial activity during time of extraction with water. On the other hand, if it be assumed that no enzymic or bacterial activity takes place, when acidity is determined by alcohol extraction, the results obtained would give a reliable index to the acidity actually present in the flour at the time of analysis. No information is available to the Committee at the present time as to just what acid-reacting materials are present in the alcoholic extract, but such information would be highly desirable and logically the next point of attack. This investigation, however, can hardly be carried on by the Committee due to the immense amount of time required for such a project.

It would appear from the present state of our knowledge in regard to acidity in flour, that the A. O. A. C. method gives results closely associated with the grade of flour. Because of enzymic activity during extraction, this method probably gives a much larger titration value than could be due to acids present in the flour before extraction. In this respect, the Greek method, although showing a fairly high positive correlation between acidity and ash content, does not follow the grade of flour exactly and would appear to give a better index as to the acidity actually present.

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**MINUTES OF SIXTEENTH ANNUAL CONVENTION OF THE AMERICAN ASSOCIATION OF CEREAL CHEMISTS**

M. D. Mize, Secretary-Treasurer

Edgewater Beach Hotel, Chicago, Ill.

May 5-9, 1930

Monday, May 5

Convention called to order at 10:15 by President M. A. Gray.

Invocation by the Reverend C. Claud Travis.

Dr. W. Lee Lewis, Director of the Department of Scientific Research, Institute of American Meat Packers, described the historical, political, and industrial condition of Chicago.

The following message of greeting was received from Mr. E. C. Veeck, president Operative Millers' Association, and read:

"When Mr. Gray, your president, for whom I have the utmost respect, asked me to bring a message to you here, I had hoped to be able to do so in person. Unfortunately circumstances have altered the possibility of my attending your convention, which I sincerely regret. I, therefore, take this means of conveying to you the few remarks I have to make."

"As president of the Operative Millers' Association, I bring to you the greetings of our association and it is our wish that this convention will be one that will result in lasting benefit not only to your organization but to the entire milling industry."

"I well remember when your organization was started and the purposes your founders had in view. I want to compliment you on the results you have accomplished, which we know have been of real value to the milling industry."

"The American Association of Cereal Chemists and many of its individual members have cooperated splendidly with the Operative Millers Association, assisting them in all questions associated with chemistry in their bulletins and also have willingly participated in the programs of both our national and district meetings. For this cooperation, I bring to you the thanks of our organization."

"In this connection, I can assure you that the Operative Millers' Association will be glad to reciprocate in giving you any assistance you may desire."

in reference to questions of mill operation. While the work of each is in its own specialized field, it is none the less closely related and for this reason a most excellent feeling should always prevail between the two.

"In fact, the best benefits can result only by maintaining the closest co-operation. We pledge you ours and we ask for a continuance of yours."

A message of greeting and good will was also received from M. F. Dillon secretary of Association of Operative Millers, and read.

Mr. Lewis E. Caster, president of American Society of Bakery Engineers, and Mr. Victor E. Marx, secretary-treasurer of American Society of Bakery Engineers, were introduced and presented greetings from their Society to the Association.

Mr. Thomas F. Smith, secretary American Bakers Association, was introduced and presented greetings from his association to the Association.

Communications from Edwin Ziegler and D. I. Andronescu were received and read.

Mr. Wm. McPherson, president American Chemical Society, sent a message of greeting and congratulation on the Association's work.

President's annual address by M. A. Gray.

The Chairmen of the Local Sections present were introduced and brought greetings from their respective sections: W. C. Meyers, Kansas City Section; C. F. Davis, Pioneer Section; R. M. Sandstedt, Nebraska Section; Paul Logue, secretary St. Louis & Central States Section; C. L. Moore, Niagara Frontier Section. C. B. Kress read communications received from J. W. Montzheimer, Pacific Northwest Section.

Appointment of convention committees by President Gray.

Nominating committee: R. J. Clark, chairman, Leslie R. Olsen, Paul Logue, R. W. Mitchell, C. B. Morison.

Auditing committee: R. K. Durham, chairman, L. E. Jackson, T. R. Aitken.

Resolutions committee: A. W. Alcock, chairman, C. B. Kress, W. C. Meyer.

A. W. Alcock presented greetings from our Canadian members.

Mary M. Brooke, chairman Local Arrangements Committee, outlined the local entertainment to take place during the convention.

Cooperative committee to work with the Operative Millers Association was appointed by President Gray: R. C. Sherwood, chairman, J. H. Julicher, A. A. Towner.

Meeting adjourned at 12:15 p. m.

Meeting called to order at 1:45 p. m. by President Gray.

Communication from T. G. Fletcher received and read.

R. L. Frye appointed in T. G. Fletcher's stead as chairman of the session.

Paper—"The Qualities of Combined Wheats as Affected by Type of Bin, Moisture and Temperature Conditions" by C. O. Swanson, read by E. B. Working.

Paper—"The Effect of Premature Freezing on Water-Imbibing Capacity of Wheat" by C. H. Bailey and E. G. Bayfield.

Paper—"Shorter Analytical Methods for Flour Mill Control" by F. X. Nodler.

Paper—"Some Basic Principles of Photography as Applied to Cereal Work" by C. G. Harrel.

Paper—"A Modification of the Swanson Mixer and Its Application to the Standard Experimental Baking Test" by W. L. Heald.

Meeting adjourned at 3:25 p. m.

Meeting called to order at 8:10 p. m. by President Gray.

A showing of moving pictures taken at the last convention of the American Society of Bakery Engineers.

Report of Committee on Methods of Testing Cake and Biscuit Flours by Mary M. Brooke, chairman.

Sub-report by R. A. Barackman, "Methods of Scoring Cake."

Sub-report by G. L. Alexander, "Mixing Time and Its Results on the Standard Baking Test."

Sub-report by V. E. Fisher, "Effect of Dough Temperature on the Standard Baking Test."

Sub-report by L. H. Bailey, "Method of Incorporating Ingredients and Its Effect on the Standard Baking Test."

Sub-report by C. H. MacIntosh, "Effects of Size and Shape of Pan on the Standard Baking Test."

Sub-report by Mary M. Brooke, "Correlation of the Standard Baking Test with Other Types of Cakes."

Sub-report by C. B. Kress, "Study of the Effect of Water Absorption on the Standard Baking Test." Mr. Kress also introduced a new formula which he has been using.

Sub-report by E. E. Smith, "Studies on Viscosity in Judging Soft Wheat Flour."

Sub-report by J. A. Dunn, "Methods of Testing Soft Wheat Flour to Be Used for Other Purposes than Cake."

Meeting adjourned at 10:30 p. m.

#### Tuesday, May 6

Meeting called to order at 9:20 a. m. by President Gray.

L. H. McLaren, presiding as chairman, took charge of the meeting.

Paper—"Factors Affecting the Weight of a Given Measure of Different Flours" by Emily Grewel.

Paper—"An Automatic Proofing Device for Bread Doughs, with Some Aspects of Its Application" by T. R. Aitken.

Paper—"Some Factors in Dough Development" by E. B. Working.

Paper—"The Relation Between Peptization of the Wheat Flour Proteins and the Baking Quality of Hard Red Spring Wheat Flour" by W. F. Geddes.

Paper—"The A. O. A. C. Gasometric Method for the Determination of Carbon Dioxide in Baking Powder" by J. R. Chittick, F. L. Dunlap and G. D. Richards. J. R. Chittick presented this paper together with the apparatus itself.

Peter G. Pirrie, associate editor of Bakers Weekly, was introduced and discussed relations between cereal chemists and bakery engineers. He suggested that cereal chemists become "production minded."

Meeting adjourned 12:15 p. m.

#### Wednesday, May 7

Meeting called to order at 9:30 by President Gray.

Moved by A. W. Alcock that each committee chairman make a motion to the effect that his own report be approved and accepted. Seconded, carried.

#### **Report of Executive Committee**

The Executive Committee has performed the many routine duties that yearly arise.

December 1st it authorized the Secretary to place at interest \$3,260.15, which had accumulated from the fellowship fund. It is the desire of the Executive Committee expressed by the unanimous vote of its members that: The Fellowship extend for a period of one calendar year (52 weeks), with two weeks vacation. The salary of the fellow is to be paid at monthly intervals. All other expenditures must receive the approval of the Executive Committee.

#### **THE FELLOWSHIP FUND**

Cooperatively working together, the Executive and Baking Committees put forth their best efforts in behalf of the Fellowship Fund.

As Chairman of the Executive Committee and as a member of the Baking Committee, it has been my duty, as well as pleasure, to communicate with each member of our association and many industrial organizations. In some instances, several letters were required to furnish the necessary explanatory information, and develop a spirit of enthusiasm.

We are conscious that there have been some minor errors, as this was almost unavoidable with the communications running into thousands.

The response as a whole has been very gratifying. All but three or four of the individual pledges made out at the Convention in Kansas City have been paid. I believe that these will pay in the near future, thus making practically 100% paid up subscriptions. Several members not making pledges in Kansas City have done so since. The total paid contributions from members amounts to \$485.00.

These individual contributions range from \$1.00 to \$25.00. There were 85 individuals making contributions, this giving an average of \$5.70 per individual contributor.

Forty-four industrial organizations made contributions totaling \$3,770.00. The maximum contribution was \$500.00 and the minimum \$10.00, or an average of \$85.68. These industrial organizations have shown a deeper interest than the act of making the contribution might imply. Most of them have appointed a representative to keep in close touch with the work as it develops. During the current year, I have received letters from many of them inquiring as to the progress we were making. This should inspire us to see that the Fellowship Fund is spent in the wisest possible manner, both from scientific and business viewpoints.

These individuals and industrial organizations have expressed their faith in our Association by their financial backing. Our task remains, the successful conduct of the work. It is a large assignment and may every member of our Association feel the responsibility it involves. Its proper solution means much to Cereal Chemistry.

Following is a list of the individual members and industrial firms making contributions:

#### INDIVIDUALS

T. R. Aitken	O. E. Gookins	M. D. Mize
G. L. Alexander	M. A. Gray	G. Moen
H. A. Baehr	Wm. R. Green	Claude L. Moore
C. H. Bailey	Emily Grewe	Leslie R. Olsen
L. H. Bailey	C. B. Gustafson	C. O. Oppen
R. A. Barackman	H. W. Hahn	E. E. Palmer
R. C. Benson	C. G. Harrel	L. H. Patten
M. J. Blish	W. L. Heald	Earl C. Paulsel
C. L. Brooke	Julius Hendel	Ralph Potts
Mary M. Brooke	C. J. Henry	W. L. Rainey
Pearl Brown	Bert D. Ingels	R. R. Rennick
Geo. H. Buford	L. E. Jackson	W. A. Richards
H. M. Butler	H. H. Johnson	Hugo Roos
Elizabeth Child	J. H. Julicher	R. M. Sandstedt
Rowland J. Clark	C. B. Kress	A. R. Sasse
A. E. Curtis	A. L. Lancaster	R. C. Sherwood
Claude F. Davis	Harold Lanning	V. Shipley
G. A. Davis	J. A. Le Clerc	C. J. Sommerville
Claude Dalbom	Fred J. Lumsden	James L. Spalding
M. F. Dillon	Paul Logue	Betty Sullivan
J. A. Dunn	C. H. MacIntosh	C. O. Swanson
R. K. Durham	Alan MacLeod	Elton L. Von Eschen
G. E. Findley	C. E. Mangels	Clarence Wards
J. T. Flohil	Max Markley	H. L. Weaver
E. N. Frank	Paul Merritt	P. I. Welk
Leo H. Fratzke	A. W. Meyer	Ernest E. Werner
V. E. Fisher	W. C. Meyer	A. G. Whiteside
R. I. Frisbie	Jan Micka	L. D. Whiting
W. F. Geddes	R. W. Mitchell	D. H. Ziel

#### INDUSTRIAL FIRMS

American Dry Milk Institute	Bakeries Service Corp.
American Bakers Machinery Co.	Bay State Milling Co.
Anheuser-Busch, Inc.	Blair Milling Co.
Ballard & Ballard	Canadian Co-op. Wheat Producers, Ltd

Cargill Elevator Co.  
 Commander-Larabee Corporation  
 Duluth Superior Milling Co.  
 Federal Mill & Elevator  
 General Mills, Inc.  
 General Baking Company  
 Gooch Milling Company  
 Hubbard Milling Co.  
 Industrial Applicance Co. (F. L. Dunlop)  
 Iliiff Bruff Chemical Co.  
 International Milling Co.  
 Kansas City Lab. Supply Co.  
 (Lee E. Clark)  
 Kansas Flour Mills  
 Kansas Milling Co.  
 King Midas Milling Co.  
 Lawrenceburg Roller Mills  
 Mennel Milling Co.  
 Midland Flour Milling Co.  
 John E. Mitchell Co.

Montana Flour Mills  
 Nebraska Cons. Mills  
 Novadel-Agene Co.  
 Pillsbury Flour Mills Co.  
 Postum Company  
 Provident Chemical Works  
 Purities Bakeries Corp.  
 Quality Bakers of America  
 (Bak. Serv. Bureau)  
 Red Star Yeast & Products  
 Russell Miller Milling Co.  
 Schulze Baking Co.  
 Standard Brands, Inc.  
 Stanard Tilton Milling Co.  
 The Biscuit & Cracker Mfrs. Assn.  
 Western Canada Flour Mills  
 W. E. Long Company  
 Walnut Creek Milling Co.  
 Central Scientific Co.

#### SUMMARY

Individual Contributions .....	\$ 485.00
Industrial Firm Contributions .....	3,770.00
	_____
Interest to July (1st) Approximately.....	\$4,250.00
	45.00
	_____
TOTAL Expenses .....	\$4,295.00
	17.25
	_____
Net amount in fund .....	\$4,278.75

Moved by C. G. Harrel that the report be accepted. Seconded, carried.

L. E. Jackson made the following report of the newly organized Convention Golf Tournament:

The Chicago members present this golf trophy under the following conditions:

This, the Chicago Trophy, is to be presented to the winner of the golf tournament held at each Annual Convention of the American Association of Cereal Chemists.

The winner is to be decided by a fair handicap.

The trophy is not permanent and must be played for each year.

The winner each year will see that the trophy is on exhibit at the next year's convention.

Moved and seconded that this report be accepted; carried.

#### Report of Employment Committee

C. B. Morison, Chairman

Letters May 6, 1929 to May 5, 1930.....	119
New names registered.....	15
Positions filled .....	4
Employers requesting assistance.....	12

Moved and seconded that this report be accepted; carried.

C. B. Kress, Chairman of Membership Committee, gave a short description of the work of his committee during the year and thanked each member.

Report of the Publicity Committee made by L. R. Olsen, assistant chairman.

**Report of Publicity Committee**

J. A. Dunn, Chairman

The publicity committee, composed of the following: Messrs. Dunn, Logue, Swanson, Myers and Miss Brown, were active in the following projects:

1. Copies of the news letter, together with reprints which were available, were sent to each magazine on our mailing list. A personal letter was included with each publicity item and the magazines were urged to make use of our publicity committee whenever they cared to. In all, over two hundred such letters were written.

2. Several articles were published in the trade press, dealing with the present convention. Pictures of the Hotel were included through the courtesy of the Hotel Management. Acknowledgment is hereby made of the excellent help of Mr. P. E. Minton, who helped us a great deal with our convention publicity.

3. The Scrap Book is much larger and has been provided with a flexible leather cover which will preserve the news items in much better condition.

4. One magazine article, containing false statements with regard to the nutritional value of certain cereal products, was referred to the Question Committee, with a request that they do their best to correct this misinformation. Another question was answered for a milling magazine—due credit being given to our Association.

The committee on Award of Osborne Medal gave no report.

Moved and seconded that the report be accepted; carried.

F. A. Collatz moved that the work of the Committee on Flour Specifications be transferred to Committee on Methods of Analysis. Seconded, carried.

**Report of History Committee**

R. W. Mitchell, Chairman

The work of this committee during the past year has consisted principally in obtaining information and data that were lacking when the last report was made. The material has been organized and a definite plan of arranging this material has been agreed upon. The work is in shape for critical study by the Association through whatever agency it may indicate. It may be added that the period of the last three years is not included in this report.

The committee hands you with this report, the material prepared and we trust that we have followed out the will of the Association.

Moved and seconded that report be accepted. Carried.

**Report of the Secretary-Treasurer**

M. D. Mize

May 7, 1930

During the past year, we have all heard a great deal about financial depreciations, stock market crashes and general deflation. But today we have the pleasure of presenting a different type of program. You will notice as you review the following financial statements and accounts that there has been a growth and advancement in all cases with one exception. The number of Corporation Members has decreased three. Not all of the increases are as large as made in previous years but they are all in the positive direction and any increase during the past year should be considered a healthy growth.

First we are listing the assets as of December 1, 1929 which gives a good idea of the net worth of the Association as practically all the 1929 expenses have been paid and none of the 1930 receipts and membership dues have been received. These assets are first listed by the bank accounts and then according to the accounts to which they belong. The total assets are, of course, much larger due to the development of the Experimental Baking Fellowship Fund by our Vice-President. The Book of Methods Reserve Fund is the only account listed which has decreased since 1929. Since last year the printing

and mailing of the last two hundred copies has been paid and the fund here listed together with the revenue that will be received from the sale of the remaining thirty-nine copies represents the net profit from this project. The Executive Committee has approved the retention of this fund for the purpose of financing the printing of a new edition of the Book of Methods at some future date when the Methods Committee deem such action necessary. I would like to take this opportunity to call to the attention of especially the new members that the thirty-nine copies still for sale in the Secretary-Treasurer's office represent the remains of the final printing of the book in its present form and orders should be placed at once if a copy is desired.

With a gain of twelve active members, one from Argentina and one from Roumania, the membership is definitely past the four hundred mark and the Membership Committee can place before themselves the long thought-of goal of five hundred with reasonable hopes of success.

This year the receipts and disbursements during the fiscal year have been listed in a new manner with hopes that the statements can be more easily understood and will be of greater value to all of our members. You may first be surprised to learn that Cereal Chemistry received practically the same revenue for both subscriptions and advertising as it does from the active membership dues. All receipts and expenditures with the exception of the Experimental Baking Fellowship Fund fall closely in line with those of previous years.

#### ASSETS AS OF DECEMBER 1st, 1929

U. S. Nat'l Bank—Savings Dept.....	\$1,000.00
First Nat'l Bank—Savings Dept.....	500.00
U. S. Nat'l Bank—Checking Account.....	1,017.60
Checks out for collection.....	12.92
Cash in Inter City Nat'l Bank.....	411.13
Petty Cash Fund in Minneapolis.....	100.00
Building & Loan Stock in Kansas City.....	2,000.00
Building & Loan Stock in Omaha.....	1,500.00
Building & Loan Stock in Minneapolis.....	1,500.00
	<hr/>
	\$8,041.65
The above assets are divided between the following accounts as here listed:	
Cereal Chemistry Assets .....	\$3,182.99
Association Assets .....	1,034.12
Book of Methods Reserve Fund .....	111.61
Convention Reserve Fund .....	452.78
Laboratory Baking Fellowship Fund .....	3,260.15
	<hr/>
	\$8,041.65

#### DETAILED MEMBERSHIP STATEMENT

	Total	Active	Corporation	Honorary
Membership, May 1, 1929.....	401	356	43	2
New members added .....	45	44	1	..
Members reinstated .....	13	13	..	..
	<hr/>	<hr/>	<hr/>	<hr/>
459	413	44		2
Members resigned 1-1-30 .....	16	15	1	..
Members suspended for non-payment of dues .....	31	28	3	..
Members deceased .....	2	2	..	..
Paid memberships 5-1-30.....	410	368	40	2
	<hr/>	<hr/>	<hr/>	<hr/>
459	413	44		2
Gain in paid memberships during during fiscal year .....	9	12	-3	0

#### FINANCIAL STATEMENT

May 1, 1929—May 1, 1930

#### RECEIPTS

##### Cereal Chemistry

Cash on hand May 1, 1929.....	\$1,825.18
Membership dues:	
Active .....	1,407.00
Corporation .....	410.00
Cereal Chemistry subscriptions.....	1,390.82
Cereal Chemistry reprints, back numbers, etc. ....	597.25
Cereal Chemistry advertising .....	1,318.00
Interest on Building & Loan Stock.....	141.44

Total ..... \$7,089.69

## Association

Cash on hand May 1, 1929.....	\$ 320.24
Membership dues, Active.....	1,404.48
Application fees .....	129.00
Interest on Building & Loan stock.....	87.97
Miscellaneous receipts .....	10.00

Total ..... \$1,951.69

## Book of Methods Fund

Cash on hand May 1, 1929.....	\$ 275.18
Cash received .....	457.23

Total ..... \$ 732.41

## Reserve Convention Fund

Cash on hand May 1, 1929.....	\$ 352.78
Cash received .....	100.00

Total ..... \$ 452.78

## Experimental Baking Fellowship Fund.....

\$4,182.37

**TOTAL RECEIPTS** ..... \$14,408.94

## DISBURSEMENTS

## Cereal Chemistry

Editing, printing and mailing Cereal Chemistry	\$3,711.52
Reprints of Cereal Chemistry .....	547.96
Commission on advertising to Managing Editor	84.40
Miscellaneous expenses; petty cash .....	567.41

Total ..... \$4,911.29

## Association

Expenses of President's and Vice-President's office and News Letter.....	194.60
Expense of Secretary-Treasurer's Office.....	409.51
Committee expenses .....	86.15
Miscellaneous expenses .....	11.83

Total ..... \$ 702.09

Building & Loan stock purchased .....	1,500.00
Book of Methods; printing and mailing .....	536.80
Experimental Baking Fellowship Fund; stationery, etc. .....	17.25

**TOTAL DISBURSEMENTS** ..... \$7,667.43

**CASH ON HAND MAY 1, 1930.** ..... \$6,741.51

## ASSETS AS OF MAY 1, 1930

## CASH ON HAND:

U. S. National Bank, Savings Dept.....	\$3,045.67
First National Bank, Savings Dept.....	1,518.97
U. S. National Bank, Checking Account.....	1,765.74
Inter City National Bank .....	411.13

Total .....	\$6,741.51
Petty cash fund in Minneapolis.....	100.00
Building & Loan stock in Kansas City.....	2,000.00
Building & Loan stock in Omaha.....	1,500.00
Building & Loan stock in Minneapolis.....	1,500.00

**TOTAL ASSETS** ..... \$11,841.51

**TOTAL LIABILITIES** ..... None

F. A. Collatz moved that the report be accepted. Seconded and carried.

**Report of Auditing Committee**

R. K. Durham, Chairman

The Auditing Committee reports that it has examined the accounts of the Secretary-Treasurer and has, so far as practicable, verified the entries therein, in the presence of the Secretary-Treasurer, reconciled his cash on hand, the Building and Loan Stock and the Savings Accounts with that actually existing in the various depositories and finds the accounts of the Secretary-Treasurer regular in every respect.

The Secretary-Treasurer has kept his records in accurate and systematic order.

Moved and seconded that the report be accepted; carried.

R. K. Durham gave a short description of the work done by the Program Committee during the past year.

Communications were read from H. D. Liggitt and from W. M. Dewey, manager of the Edgewater Beach Hotel.

#### **Report of Question Committee**

Julius Hendel, Chairman

The Question Committee has been doing good work this year. Every one in the Committee, Betty Sullivan, L. H. McLaren, Hugo Ross and M. F. Dillon have been very enthusiastic and have contributed to the success of the work of the Committee.

A circular letter was sent to the milling trade in the United States and Canada, as well as Europe, inviting them to take advantage of the Question Committee of our Association and, in response to that letter, we have been receiving on the average of one to two questions a week, half of which have come from Europe. Dr. C. H. Bailey and Dr. Sherwood were kind enough to assist us.

We feel that the Committee is cooperating in this work, especially Miss Betty Sullivan, who took charge of the work during my absence.

Moved and seconded that the report be accepted; carried.

#### **Report of Committee on Resolutions**

A. W. Alcock, Chairman

Be it resolved that we record in the minutes an expression of our indebtedness to the Program Committee in arranging the excellent program for our 16th Convention.

Be it also resolved that the sincere thanks of the Association be conveyed to the Chairman and members of the Local Arrangements Committee and that we especially acknowledge our gratitude to Mr. Victor Marx for making the hotel arrangements and to Mrs. R. Bohn and Mrs. A. W. Meyer for their services in preparing the program of entertainment for the ladies.

Be it resolved that the Secretary be instructed to communicate our thanks to Dr. C. Claud Travis for his kindness in delivering the Invocation; to Dr. W. Lee Lewis for his extremely interesting address; to the Corn Products Company and the Swift Company for their courtesy in allowing us to visit their plants; to the American Institute of Baking for permitting us to hold one of our meetings in their building; to Messrs. Bausch & Lomb for the loan of the Balopticon and to the Management of the Edgewater Beach Hotel for the very satisfactory treatment accorded to the Association and to the members individually.

Be it resolved that we express the sense of gratitude we all feel to the Chairmen and members of the various standing committees for their labors during the past year and especially to Mr. C. G. Harrel whose unremitting efforts have led to the collection of sufficient funds to establish a baking fellowship.

Be it also resolved that we extend our thanks to the officers of this Association and to the editors of Cereal Chemistry whose faithful services to our organization are here gratefully acknowledged.

Be it further resolved that the Association express its appreciation of the friendly spirit shown by the Association of Operative Millers, the Millers National Federation and the American Society of Bakery Engineers and that we extend to these organizations our cordial greetings and indicate our keen desire that our happy relationship with them may be maintained.

Be it resolved that we convey to Dr. R. A. Gortner, the Chairman of our Medal Committee, an expression of our deep sympathy with him in the great loss he has sustained through the death of his wife and of our hope that his son may soon be restored to health.

**Report of the Editor-in-Chief**

Due to the rigid economies exercised by the office of the Managing Editor it proved possible to publish a larger volume of Cereal Chemistry in 1929 than heretofore. It appears that the financial position which enabled us to thus expand the Journal is largely the result of saving in clerical expense, which the Managing Editor has effected through the use of a large amount of his own time.

This arrangement is distinctly unfair, and must be met by either additional appropriations for clerical assistance, or by a reduction in the size of the journal, thus effecting the diversion of additional funds from the Cereal Chemistry income to managerial and editorial expense.

During the past fiscal year the Editor-in-Chief, with the counsel and approval of the officers and Executive Committee, proposed to members of the Association and subscribers to the Journal that an effort be made to publish a series of Cereal Chemistry Monographs. You all received at least one and possibly two letters during the past few months, directing your attention to this enterprise and soliciting your subscriptions to this monograph series.

The purpose as disclosed in these letters is to insure the financing of the publication of papers which are too extensive to be printed in Cereal Chemistry. No definite number of monographs in any year is contemplated, it being intended that these will be printed only as suitable manuscripts become available to us.

The response to our request for subscriptions has been somewhat disappointing, less than half of those to whom such requests were directed having actually responded. To date the total number of subscriptions is less than 300, and the editors feel that a minimum of 400 bona fide subscriptions must be entered on our books before we can safely proceed with the publication of the first monograph and at the same time insure that it can be invoiced to the subscribers at a reasonable price.

As was indicated in the follow-up letter addressed to the majority of our members and subscribers, the progress that is made by any subdivision of applied science is registered in no small measure in terms of the literature of that field of specialization. Unless cereal chemists support the printing of new and worth-while material they will not only fail to register in the minds of the scientific public as well as in the industries, but will be actually defrauding themselves to the extent that they are closing doors to those channels of publication which might serve to bring to them at periodic intervals much useful material. The earnest and whole-hearted support of every member of the Association in this enterprise is solicited.

—C. H. Bailey.

**Report of Managing Editor**

The report of the Managing Editor covers the calendar year January 1 to December 31, 1929, and includes income and expenditures for Volume VI of Cereal Chemistry.

The report of the Secretary-Treasurer shows the financial status of Cereal Chemistry at the time his books were closed for his report to the convention. This report of Cereal Chemistry balance is liable to be misleading since a large proportion of the income for the entire year has been received by the Secretary-Treasurer, but only a small proportion of the year's expenses has been paid. Hence the report of the Managing Editor will be a statement of the operation of Cereal Chemistry for 1929.

Cereal Chemistry has four main sources of income: membership dues (including corporation members), subscriptions, advertisements, and sale of back volumes bound and unbound. As indicated occasionally in our advertising columns, there is a supply of back issues available. This number is decreasing, however, and if there are members whose files are not complete, we would advise them to make the necessary purchases before it is too late. Certain issues have been depleted until our supply is only about 100. Therefore, we have curtailed the sale of many of the single issues in order to be able to supply the maximum number of complete volumes.

Total income credited to Volume VI is \$4,969.37. Of this amount \$1,801.50 was received from memberships, \$1,361.50 from active members, and \$440.00

from corporation members. This constitutes 36% of the receipts. Advertising income was \$1320.00 or 27% of the receipts. Subscriptions yielded \$1246.55, or 25% of the income. The sale of back issues and bound volumes continues, income from this source amounting to \$413.77, or 8% of the total. Income from reprints was \$124.66 or 3% of the total. Miscellaneous income of \$62.89 made up the balance.

The itemized income statement shows that members and subscribers contribute only about 60% of the total. This is the same percentage found in 1928. Advertising income was \$26.00 less than in 1928. Members are again urged to patronize the advertisers in Cereal Chemistry and where possible, give preference to those who aid in supporting our Journal.

Members of the Association can aid in increasing the income of Cereal Chemistry. Obviously, the greatest benefit both for Cereal Chemistry and the Association as a whole, is to add new members. New subscribers will assist the Journal and members of the Association can be of real service by keeping a lookout constantly for prospective subscribers. Corporation memberships are a substantial means of support and no doubt there are many firms, both large and small, who would welcome an opportunity to support our Journal.

Total expenditures for Volume VI were \$4835.38, leaving a balance of \$133.99. As in previous years the largest item of expense was printing the Journal, which cost was \$3041.42. This is about 63% of the expenditures. Additional printing costs were \$428.65 for reprints, or 9% of the expenditures. Of this amount \$300.00 was paid for author's reprints, 50 copies of which were donated to each author. Income from additional reprints sold to authors was insufficient last year to cover all costs, so a new schedule of reprint prices was put into effect with the first issue printed in 1930. Editorial expense including copy and proof reading, and stenographic work, amounted to \$1053.55 which was 22% of the total expense. Miscellaneous items including stationery, mailing envelopes, postage, etc., amounted to \$311.76.

Increased expenditures for 1929 were due principally to larger expenses involved in increasing the size of the Journal. Volume VI contained 552 pages, 60 pages more than Volume V, and 46 pages more than Volume IV. The cost per page of Volume VI was \$8.76, for an average of 92 pages per issue.

The total mailing list is larger now (May 1, 1930) than it was a year ago. It includes 776 paid subscribers and members of which 411 are members and 365 are subscribers. The number of domestic members and subscribers is 517, foreign 259.

As most members are aware, the Journal is printed under contract. The editors endeavor to keep costs as low as consistent with high quality printing. It was decided last year to reconsider bids for printing, therefore several printers in Minneapolis were interviewed and bids were later received for printing Cereal Chemistry in 1930. The Lund Press was the successful bidder and began printing the Journal in January, 1930.

### CEREAL CHEMISTRY

#### FINANCIAL STATEMENT

1929

<b>Receipts:</b>		
Memberships .....	\$1,801.50	
Subscriptions .....	1,246.55	
Back Files .....	413.77	
Reprints .....	124.66	
Advertising .....	1,320.00	
Miscellaneous .....	62.89	
<b>Disbursements:</b>		
Cost of Journal printing .....	\$3,041.42	
Reprints .....	428.65	
Postage, stationery, miscellaneous printing .....	311.76	
Labor, editorial and stenographic .....	1,053.55	
		<b>4,885.38</b>
<b>Net Profit .....</b>		<b>\$133.99</b>

—R. C. Sherwood.

Moved and seconded that the report be accepted; carried.

A. W. Alcock moved that the minutes of the 1929 Convention be accepted as published in Cereal Chemistry. Seconded, carried.

Report of Nominating Committee by R. J. Clark, chairman.

Election of officers.

President—C. G. Harrel

Vice-President—R. K. Durham

Secretary-Treasurer—M. D. Mize

Editor-in-Chief—C. H. Bailey

Managing Editor—R. C. Sherwood

M. A. Gray moved that a check for \$100.00 be drawn on the association in favor of M. D. Mize as a token of appreciation of his work during the past year. Seconded, carried.

Meeting adjourned at 12:15 p. m.

American Institute of Baking, Chicago, Ill.

Meeting called to order at 2:15 p. m. by President Harrel.

Meeting then placed in charge of C. H. Bailey, chairman of Committee on Standardization of Laboratory Baking.

C. H. Bailey delivered report of his committee.

Moved and seconded that the report be accepted. Carried.

Paper—"Comparison of Various Baking Procedures" by G. Moen.

Paper—"A New Constant Temperature Fermentation Cabinet" by C. H. Bailey.

Paper—"Experiments with Various Types of Machine Molders" by C. C. Fifield.

Paper—"Calibration of Loaf Measuring Devices by Means of Aluminum Moulds" by C. H. Bailey.

Paper—"Dough Testing Thermometers" by R. C. Sherwood.

The laboratories and bake shops of the Institute were then open for the inspection of delegates present. Machine mixing and moulding of the small experimental loaf were demonstrated as well as two types of automatic temperature controlled ovens. The following members of the staff of the Institute were introduced: C. B. Morison, Dean; W. Walmsley, practical baking instructor; J. E. Morrill, baking and baking ingredients instructor; H. C. Martens, science teacher, and J. R. Swint, shop practice assistant instructor.

Meeting adjourned 4:00 p. m.

#### Thursday, May 8

Meeting called to order at 8:30 p. m. by President Harrel.

Local Section Session.

Northwest Section Paper—"The Testing of New Northwestern Wheat Varieties" by R. C. Sherwood.

Kansas City Section Paper—"Cereal Chemistry Today" by R. J. Clark.

Nebraska Section Paper—"The Gluten Proteins" by M. J. Blish.

Pioneer Section Paper—"The Status Quo of the Pioneer Section" by C. F. Davis.

St. Louis & Central States Section Paper—"Stability of Leavening in Self Rising Flour" by Paul Logue and Elizabeth McKim.

Niagara Frontier Section Paper—"How the American Association and Local Sections Can Be of Greater Benefit to Each Other" by C. L. Moore.

Pacific Northwest Section Paper—"Problems Peculiar to the Cereal Chemist in the Pacific Northwest" by T. R. James and J. W. Montzheimer; read by C. B. Kress.

M. A. Gray described the activities of the American Society of Bakery Engineers and expressed the hope of greater cooperation between our association and the Engineers. L. E. Caster, president of the American Society of Bakery Engineers and Peter G. Pirrie, associate editor of Bakers Weekly, were introduced and invited to speak. Mr. Caster said that the objective in cooperation for both the Association and the Society was for both to see and realize the problems and objects of the other. President Harrel asked a question on the angle of repose for wheat and flour and considerable discussion

followed. W. V. Vanscoyk asked a question about the amount of temperature increase in dough due to mixer friction; several methods of obtaining this information were described. The question of the loss of weight in a dough during fermentation was also brought up. M. A. Gray expressed his views on the difference in flavor between laboratory bread and commercial bread. During the discussion of this question, the effects of wax paper were mentioned.

Mr. Caster expressed his desire for the appointment of joint committee by the Association and the Society.

Meeting adjourned 12:25 p. m.

### Friday, May 9

Meeting called to order at 9:00 a. m. by President Harrel.

President Harrel appointed the following standing committees for the year:

#### Executive Committee

C. E. Mangels  
L. D. Whiting

R. K. Durham, Chairman  
M. A. Gray

#### Committee on Allied Associations

Leslie R. Olsen, Chairman

H. E. Weaver

#### Membership Committee

A. D. Wilhoit, Chairman  
W. L. Heald  
Bert Ingels  
T. R. Aitken  
Claude F. Davis  
Wm. V. Vanscoyk  
Pearl Brown

W. E. Richards  
E. L. Von Eschen  
Harry Liggitt  
J. A. Le Clerc  
J. W. Montzheimer  
L. E. Jackson

#### Committee on Methods of Analysis

John T. Flohil, Chairman  
D. A. Coleman  
F. A. Collatz

A. E. Treloar  
A. W. Meyer  
W. C. Meyer

#### Committee on Standardization of Laboratory Baking

C. H. Bailey, Chairman  
M. J. Blish  
G. Moen  
R. K. Larmour  
R. J. Clark

E. B. Working  
H. E. Weaver  
L. R. Olsen  
M. A. Gray

#### Committee on Methods of Testing Cake and Biscuit Flours

Mary M. Brooke, Chairman  
L. H. Bailey  
C. H. MacIntosh  
J. A. Dunn

E. E. Smith  
Geo. L. Alexander  
L. E. Jackson  
C. B. Kress

#### Committee on Employment

C. B. Morison, Chairman  
M. D. Mize

L. E. Clark  
Paul Sherrick

#### Committee on Publicity

L. H. McLaren, Chairman  
P. E. Minton  
C. B. Morison

Paul Logue  
A. W. Alcock  
E. F. Tibbling

#### Committee on Osborne Medal Awards

R. A. Gortner, Chairman  
C. L. Alsberg  
M. A. Gray

C. J. Patterson  
C. O. Swanson

**Question Committee**

Julius Hendel, Chairman  
 L. H. McLaren  
 Fred Hildebrand

Hugo Roos  
 M. F. Dillon  
 W. F. Geddes

**History Committee**

R. W. Mitchell, Chairman  
 J. A. Le Clerc

S. J. Lawellin

**Convention Program Committee**

A. A. Schaal, Chairman

Emily Grewe

**Convention Peptizer**

J. A. Dunn.

Paper—"The Staling of Bread" and a demonstration of its measurement by Washington Platt.

Paper—"Wheat Protein Test Digestion Studies" by C. F. Davis.

Paper—"Vitamin D and the Antirachitic Activation of Foods by Irradiation with Ultraviolet Light" by F. L. Gunderson.

Paper—"Cereal and Mineral Metabolism" by M. S. Fine.

Demonstration of the Tag Heppenstall Moisture Meter by D. A. Coleman.

Convention adjourned by President C. G. Harrel.

**REGISTRATION AT CONVENTION, CHICAGO, ILLINOIS**

**MAY 5-9, 1930**

**Members**

H. Adler, Victor Chemical Works, Chicago Heights, Ill.  
 T. R. Aitken, Board of Grain Commissioners, Research Dept., Winnipeg, Manitoba, Canada.  
 A. W. Alcock, Western Canada Flour Mills, Winnipeg, Manitoba, Canada.  
 Geo. L. Alexander, Pillsbury Flour Mills, Springfield, Ill.  
 H. M. Anthony, J. R. Short Milling Co., Chicago, Ill.  
 H. A. Baehr, Topeka Flour Mills Corp., Topeka, Kansas.  
 C. H. Bailey, University Farm, St. Paul, Minn.  
 Lorin H. Bailey, Bureau of Chemistry & Soils, Dept. of Agri., Washington, D. C.  
 John C. Baker, Novadel Agene Corp., Newark, N. J.  
 R. A. Barackman, Victor Chemical Works, Chicago, Ill.  
 E. G. Bayfield, Ohio Exp. Station, Wooster, Ohio.  
 R. T. Beatty, The Northwestern Miller, Minneapolis, Minn.  
 W. A. Bergman, Industrial Appliance Co., Chicago, Ill.  
 M. J. Blish, Agricultural College, Lincoln, Nebr.  
 Ralph M. Bohn, C. S. Miner Laboratories, Chicago, Ill.  
 Mary Minton Brooke, Purity Bakeries Corp., Chicago, Ill.  
 L. G. Brown, Noblesville, Ind.  
 Pearl Brown, Perfection Biscuit Co., Fort Wayne, Ind.  
 W. E. Brownlee, United Mills Co., Inc., Grafton, Ohio.  
 T. E. Carl, Standard Brands, Inc., New York, N. Y.  
 J. R. Chittick, Jaques Manufacturing Co., Chicago, Ill.  
 Lee E. Clark, Kansas City Laboratory Supplies, Kansas City, Mo.  
 Rowland J. Clark, Schulze Baking Company, Kansas City, Mo.  
 Al Cliffe, Standard Brands, Ltd., Toronto, Ont., Canada.  
 D. A. Coleman, Bureau of Agri. Economics, Washington, D. C.  
 F. A. Collatz, General Mills, Minneapolis, Minn.  
 A. E. Curtis, 20 W. 69th Terrace, Kansas City, Mo.  
 S. E. Danielson, Quaker Oats Co., Akron, Ohio.  
 C. F. Davis, Western Star Milling Co., Salina, Kansas.  
 F. L. Dunlap, Consulting Chemist, Monadnock Bldg., Chicago, Ill.  
 J. Avery Dunn, Novadel Agene Corp., Toronto, Canada.  
 R. K. Durham, Rodney Milling Co., Kansas City, Mo.  
 W. G. Epstein, B. A. Milling Co., Chicago, Ill.  
 C. C. Fifield, U. S. Dept. of Agriculture, Washington, D. C.

G. E. Findley, Morton Milling Company, Dallas, Texas.  
V. E. Fisher, Stanard-Tilton Milling Company, Alton, Ill.  
Augustus H. Fiske, Rumford Chemical Works, Rumford, Rhode Island.  
J. T. Flohil, Pillsbury Flour Mills, Minneapolis, Minn.  
Chauncey E. Foster, Minneapolis, Minn.  
L. H. Fratzke, Western Flour Mills, Davenport, Iowa.  
R. L. Frye, Bewley Mills, Fort Worth, Texas.  
W. F. Geddes, Dept. of Agr. Chem., Univ. of Manitoba, Winnipeg, Manitoba.  
W. E. Glasgow, Cargill Elevator Company, Minneapolis, Minn.  
Philip Goldfisch, Laboratory Construction Co., Kansas City, Mo.  
H. C. Gore, Standard Brands, Inc., New York, N. Y.  
M. A. Gray, Pillsbury Flour Mills, Minneapolis, Minn.  
N. L. Gregory, Maple Leaf Milling Co., Ltd., Port Colborne, Ont.  
Emily Grewe, Bureau of Dairy Industry, Washington, D. C.  
C. B. Gustafson, National Soft Wheat Millers Ass'n., Nashville, Tenn.  
L. W. Haas, W. E. Long Company, Chicago, Ill.  
H. A. Halvorson, State Testing Mill, Minneapolis, Minn.  
Robert C. Harnsberger, The Page Milling Co., Luray, Virginia.  
C. G. Harrel, Commander-Larabee Corp., Minneapolis, Minn.  
W. L. Heald, Commander-Larabee Flour Mills, Kansas City, Mo.  
Julius Hendel, Cargill Mill & Elevator, Minneapolis, Minn.  
Ralph S. Herman, Washburn-Crosby Co., Buffalo, N. Y.  
Fred Hildebrand, H. C. Bohack Co., Garden City, New York.  
John Holt, Crete Mills, Crete, Nebr.  
G. E. Howe, Lyon & Greenleaf Co., Inc., Ligonier, Ind.  
Bert D. Ingals, Wallace & Tiernan Co., Inc., East Orange, N. J.  
L. E. Jackson, Victor Chemical Works, Chicago, Ill.  
H. H. Johnson, Gooch Milling Company, Lincoln, Nebr.  
J. H. Julicher, Pillsbury Flour Mills Co., Buffalo, N. Y.  
C. B. Kress, Sperry Flour Company, San Francisco, Cal.  
A. L. Lancaster, Blair Milling Co., Atchison, Kansas.  
S. W. Lawellin, Novadel-Agene Corp., New Ulm, Minn.  
L. E. Leatherock, Kansas Milling Co., Wichita, Kansas.  
J. A. LeClerc, Department of Agriculture, Washington, D. C.  
Paul Logue, Provident Chemical Co., St. Louis, Mo.  
J. M. Lugenbeel, Merchants Exchange, St. Louis, Mo.  
Fred Lumsden, 520 Flour Exchange, Minneapolis, Minn.  
C. H. MacIntosh, C. J. Patterson Corp., Kansas City, Mo.  
L. H. McLaren, Shellabarger Mills, Salina, Kansas.  
Alan MacLeod, Canadian Wheat Pool, Winnipeg, Canada.  
D. A. McTavish, Quaker Oats Co., Peterborough, Ontario, Can.  
A. W. Meyer, W. E. Long & Co., Chicago, Ill.  
W. E. Meyer, Ismert-Hincke Milling Co., Kansas City, Mo.  
J. Micka, Seibel Institute of Technology, Chicago, Ill.  
C. S. Miner, Miner Laboratories, Chicago, Ill.  
P. E. Minton, Southern Cotton Feeding Co., Chicago, Ill.  
H. S. Mitchell, Swift & Co., Chicago, Ill.  
R. Wallace Mitchell, American Bakery Materials Co., Menomonie, Wis.  
M. D. Mize, Omaha Grain Exchange, Omaha, Nebr.  
G. Moen, General Mills, Minneapolis, Minn.  
Claude L. Moore, Washburn Crosby Co., Buffalo, N. Y.  
C. B. Morison, American Institute of Baking, Chicago, Ill.  
Charles T. Newell, Burrus Mill & Elev. Co., Fort Worth, Texas,  
F. X. Nodler, Plant Flour Mills, St. Louis, Mo.  
C. R. Norman, Osborne McMillan Elevator Co., Minneapolis, Minn.  
A. G. Olsen, General Foods, Battle Creek, Mich.  
Leslie R. Olsen, International Milling Co., Minneapolis, Minn.  
Clarence Oppen, Lawrenceburg Roller Mills Co., Lawrenceburg, Ind.  
Every M. Pagot, Phosphate Dvn. Rumford Chemical Wks., Chicago, Ill.  
L. H. Patten, State Mill & Elevator, Grand Forks, N. D.  
F. D. Patterson, Texas Star Flour Mills, Galveston, Texas.  
Earl C. Paulsel, International Milling Co., Minneapolis, Minn.

L. W. Pingree, Wallace & Tiernan Co., Inc., Ogden, Utah.  
 P. R. Pitts, Model Mill Co., Johnson City, Tenn.  
 Washington Platt, Merrell Soule Co., Syracuse, N. Y.  
 Ralph B. Potts, Wichita Flour Mills, Wichita, Kansas.  
 Glenn L. Pyle, Consolidated Flour Mills Co., Wichita, Kansas.  
 Herbert Renner, W. E. Long Co., Chicago, Ill.  
 W. A. Richards, International Milling Co., Buffalo, N. Y.  
 R. M. Sandstedt, University of Nebraska, Lincoln, Nebr.  
 T. W. Sanford, Eagle Roller Mills, New Ulm, Minn.  
 A. A. Schaaf, Biscuit & Cracker Mfrs. Ass'n., Minneapolis, Minn.  
 Paul Sherrick, Central Scientific Co., Chicago, Ill.  
 R. C. Sherwood, General Mills, Minneapolis, Minn.  
 V. Shipley, National Milling Co., Toledo, Ohio.  
 F. P. Siebel, Jr., Siebel Institute of Technology, Chicago, Ill.  
 Oscar Skovholt, University Farm, St. Paul, Minn.  
 E. E. Smith, F. W. Stock Co., Hillside, Mich.  
 Edward S. Soesman, Maple Leaf Milling Co., Ltd., Medicine Hat, Alberta.  
 John A. Strang, Wallace & Tiernan Co., Kansas City, Mo.  
 W. H. Strowd, Soft Wheat Millers Ass'n., Nashville, Tenn.  
 Betty Sullivan, Russell-Miller Mfg. Co., Minneapolis, Minn.  
 W. Kedzie Toller, The Columbus Laboratories, Chicago, Ill.  
 G. Cullen Thomas, General Mills, Inc., Minneapolis, Minn.  
 E. F. Tibbling, Washburn-Crosby Co., Kansas City, Mo.  
 A. A. Towner, Red Star Milling Co., Wichita, Kansas.  
 W. V. Vanscoyck, Valier-Spies Milling Co., St. Louis, Mo.  
 E. L. Von Eschen, Bakeries Service Corp., Jamaica, L. I., N. Y.  
 H. G. Walter, Igelhart Brothers, Evansville, Ind.  
 M. R. Warren, Quaker Oats Co., Cedar Rapids, Ia.  
 S. O. Werner, Northwestern Miller, Chicago, Ill.  
 L. D. Whiting, Ballard & Ballard Co., Louisville, Ky.  
 A. D. Wilhoit, A. D. Wilhoit Laboratory, Minneapolis, Minn.  
 Earl B. Working, Kansas City Agriculture College, Manhattan, Kansas.

#### Visitors and Guests

F. J. Bergenthal, Red Star Yeast & Products Co., Milwaukee, Wisc.  
 Douglas L. Boyer, Provident Chemical Wks., St. Louis, Mo.  
 George T. Carlin, Swift & Co., Chicago, Ill.  
 Louis E. Caster, Keig-Stevens Baking Co., Rockford, Ill.  
 N. T. Cunningham, Ralston-Purina Co., St. Louis, Mo.  
 R. S. Dixon, Calumet Chemical Co., Joliet, Ill.  
 Newton C. Evans, National Miller, Evanston, Ill.  
 R. M. Finch, Wallace & Tiernan Co., Inc., Minneapolis, Minn.  
 E. N. Frank, International Milling Co., Minneapolis, Minn.  
 Robert Gordon Gould, McGraw-Hill Publishing Co., Inc., New York, N. Y.  
 H. L. Grapp, Despatch Oven Co., Minneapolis, Minn.  
 John P. Ioannu, Penna. Salt Manufacturing Co., Philadelphia, Pa.  
 S. L. P. Karacsonyi, 225 Doswell Ave., St. Paul, Minn.  
 Rowland Kufeld, Walnut Creek Milling Co., Great Bend, Kansas.  
 J. C. Larkenow, Loose Wiles Biscuit Co., Long Island City, N. Y.  
 C. H. Lommel, Pinnacle Mills, Morristown, Tenn.  
 Victor E. Marx, Bakers Helper, Chicago, Ill.  
 A. H. Mitchell, American Miller, Chicago, Ill.  
 Charles P. Oliver, Standard Brands, Inc., New York, N. Y.  
 V. Parker, Maple Leaf Milling Co., Ltd., Kenora, Ontario.  
 M. H. Parlin, Lysle Milling Co., Leavenworth, Kansas.  
 C. W. Partridge, Industrial Appliance Co., Chicago, Ill.  
 Peter Pirrie, Bakers Weekly, New York, N. Y.  
 Roger W. Pratt, Wallace-Tiernan Co., Kansas City, Mo.  
 A. W. Putland, Armour & Company, Chicago, Ill.  
 O. H. Raschke, Victor Chemical Works, Chicago, Ill.  
 Tom Smith, American Bakers Assn., Chicago, Ill.  
 Lora K. Track, Standard Brands, Brooklyn, N. Y.

James D. Veron, Anheuser-Busch Co., St. Louis, Mo.  
Gordon Warstler, Lyon Greenleaf Co., Inc., Ligonier, Ind.  
E. E. Werner, 6625 Delmar Blvd., St. Louis, Mo.  
O. B. Winter, Michigan State College, E. Lansing, Michigan.  
W. B. Young, Minnesota Protein Laboratory, Minneapolis, Minn.  
Mrs. R. T. Beatty, Minneapolis, Minn.  
Mrs. R. M. Bohn, Evanston, Ill.  
Mrs. Rowland J. Clark, Kansas City, Mo.  
Mrs. F. A. Collatz, Minneapolis, Minn.  
Mrs. W. G. Epstein, Chicago, Ill.  
Mrs. J. T. Flohil, Minneapolis, Minn.  
Mrs. E. N. Frank, Minneapolis, Minn.  
Mrs. M. A. Gray, Minneapolis, Minn.  
Mrs. C. G. Harrel, Minneapolis, Minn.  
Mrs. Bert D. Ingels, Newark, N. J.  
Mrs. Rowland Kufeld, Great Bend, Kans.  
Mrs. James Lugenbell, St. Louis, Mo.  
Mrs. C. H. MacIntosh, Kansas City, Mo.  
Mrs. Alan MacLeod, Winnipeg, Canada.  
Mrs. A. W. Meyer, Chicago, Ill.  
Mrs. W. C. Meyer, Kansas City, Mo.  
Mrs. P. E. Minton, Oak Park, Ill.  
Mrs. R. W. Mitchell, Menomonie, Wis.  
Mrs. G. Moen, Minneapolis, Minn.  
Mrs. C. L. Moore, Buffalo, N. Y.  
Mrs. F. X. Nodler, St. Louis, Mo.  
Mrs. Leslie Olsen, Minneapolis, Minn.  
Mrs. Earl C. Paulsel, Minneapolis, Minn.  
Mrs. W. A. Richards, Buffalo, N. Y.  
Mrs. T. W. Sanford, New Ulm, Minn.  
Mrs. A. A. Schaal, Minneapolis, Minn.  
Mrs. R. C. Sherwood, St. Paul, Minn.  
Mrs. V. Shipley, Walbridge, Ohio.  
Mrs. E. E. Smith, Hilldale, Mich.  
Mrs. M. R. Warren, Cedar Rapids, Ia.  
Mrs. O. B. Winter, E. Lansing, Mich.

### ADDRESS OF THE PRESIDENT

M. A. GRAY

(Read at the Convention, May, 1930)

Another year has passed and we are assembled for our Sixteenth Annual Convention. As in the past, we have continued to make progress; in fact, the history of the American Association of Cereal Chemists has been one of continual advancement, and while our development has never been spectacular, the aggregate of fifteen years of effort stands out as an achievement well worthy of mention.

Picture, if you can, the chaotic conditions prior to the organization of our Association. With only crude equipment available, results were for the most part inaccurate. The methods and equipment in common use were inadequate to meet the exacting demands of new development. Our ash determinations were made in inferior porcelain crucibles, incineration taking place in inefficient gas furnaces. The old water-bath oven was used for making moisture determinations, but even worse were conditions surrounding the baking test. Add to this our inexperience at that period and one can hardly visualize a more discouraging situation.

Since comparable results were impossible, the work of the mill chemist met with constant criticism. Government and state chemists compared our analytical data and pointed out the danger of attempting to control milling operations by laboratory measures, so, in the hope that some discussion of their problems might prove advantageous, a small pioneer group of mill chemists banded together in what was to be the nucleus of the present Association. Unquestionably these pioneers had vision and courage, probably not unmixed with desperation, for it will readily be understood that there must have been times when they feared that unless they could place themselves on a more solid foundation, cereal chemistry as a practical aid to the milling industry could not progress and might not even survive.

As a result of this movement we have an entirely different picture today. The first membership (eleven in all) has now grown to over four hundred. However, it is not only in the matter of numbers that we can take pride, but also because of the fact that the men and women who have allied themselves with this Association have been for the most part of that earnest, determined type which was not deterred by what appeared at times to be insurmountable obstacles. We have been able to attract to our membership not only mill chemists but also men engaged in allied industries as well as Government officials engaged in research and educational work.

One of the greatest factors which makes for progress and success is our dissatisfaction with anything we already possess. Had we been satisfied with ox teams we would not have the automobile nor tractor; had we been content to have our women grind meal by hand we would not have the magnificent flour mills of today; likewise, had we been willing to accept the laboratory apparatus and methods of fifteen years ago as adequate for our needs, we would not have the splendid equipment which has been developed and perfected to make the laboratory of the cereal chemist the acme of speed and efficiency it is today.

While the equipment manufacturers are entitled to considerable credit for having given so liberally of their time, money, and co-operation in these important developments, it would be unfair not to recognize the part played by the cereal chemist himself. He has steadfastly refused to be content with imperfect equipment, or tolerate any kind of makeshift, and it is largely this attitude that has furnished the impetus for the laboratory equipment manufacturers who have been quick to respond. Therefore, as another year closes with this convention, we can again point to further progress, and you should find the program most interesting inasmuch as it presents the results of twelve months research and study in the field of cereal chemistry as well as the development of certain mechanical devices necessary for our further advancement.

For years this Association has been endeavoring to perfect the baking test and inaugurate something that would meet the needs of a varied demand, but has always met with much discouragement. Committee after committee has worked diligently throughout the years, never wholly successful, but always presenting the results of their labors with hope for the future. Every year a new committee went forth fully determined to find a solution for the most complex problem we have yet undertaken, and never has this particular phase of our research lost the support or interest of the Association.

The 1928 Baking Committee, under the chairmanship of C. G. Harrel, was still unable to solve the problem but did demonstrate very clearly the factors which have been largely responsible for our failures, and after carefully considering his report it was decided that the work would be best handled by means of a research fellowship, such fellowship to be established at some suitable institution under the direction of a committee.

The present Baking Committee, with Dr. Bailey as its leader, was selected from men who were exceptionally well qualified to serve because of their long experience on previous committees as well as constant study of this particular problem in their own laboratories, and although you may not have heard very much about the work of this group in the past year, I can assure you it has not been inactive.

Aside from the tremendous task of raising sufficient funds (which has been accomplished almost entirely by the untiring and persistent efforts of Mr. Harrel) it was of the greatest importance that some means be devised whereby the variations due to the manipulation of doughs by hand could be overcome. Through the years that the Association has been wrestling with this problem many methods have been studied, but after the smoke has cleared away, one in particular seems to stand out as meeting with most favor, and while certain modifications are likely to be adopted, the basic principles still survive. For the basic formula and method due credit must of course be given to Dr. E. E. Werner.

After accepting the conclusions of our best minds as to the method, it was obviously necessary that the operation of manipulating the dough consistently and uniformly must be a mechanical one. The unusual size of the dough put standard baking machinery out of the question, but our baking committee was successful in interesting the Hobart Manufacturing Company sufficiently for them to specially design a suitable mixer. The committee was also able to interest the Thomson Machine Company to the extent of developing a moulder, and as a consequence they have scaled down and adapted one of their standard type machines to suit our needs. Both machines will be seen in operation at the American Institute of Baking, Wednesday afternoon, May 7th. We have great hope that this will mark another step forward.

It gives me great pleasure to announce that we have been able to raise a sufficient fund to support our research work under a fellowship for the period of one year. We have chosen the institution where the work will be carried out, and from a large number of applicants for the fellowship, one has been selected who stands out as being pre-eminently fitted for this work, which is a guarantee that it will be completed with the least delay and in the most satisfactory manner.

I can assure you that the Baking Committee has fully appreciated its responsibility in making its decisions. With the realization that sufficient money was available for only one full year's work and that it would be difficult again to raise a like sum, they were convinced that unless the work could be completed the first year, a difficult situation might result. However, it did seem probable that in the event we were able to obtain the services of a man who by education, experience, and ability was especially qualified to conduct this research, there could be little doubt about fully completing the work in the given time. With the entire year spent in preparation and with a background of several years study and investigation by the previous baking committees, I believe we are fully justified in predicting that a year hence—at our next Annual Convention—the 1930 baking committee will be in a position to stage the demonstration of a completely developed test baking method which can be presented to the association with the recommendation that it be adopted as the official baking method of the American Association of Cereal Chemists.

This work was started some six years ago and I doubt if there is a man here today who at that time appreciated the extent of the problem ahead. Possibly we are too optimistic, but personally I feel very hopeful and believe we are nearing a satisfactory solution.

There is still another phase of our Association's activities which should be fostered and encouraged.

Prior to 1926, groups of Cereal Chemists in centers throughout the country felt the need of closer contact and more frequent opportunities for meeting than those afforded by the National Organization, and in order to bring this about they formed what were known as "Chemists' Clubs." This movement was activated by exactly the same spirit as was responsible for the organization of the American Association of Cereal Chemists in 1915. At our 1926 Convention there were five local clubs in existence. They were doing such good work that Rowland J. Clark, then President of the Association, recommended that they be given recognition and made sections of the National Association, a proposal which was adopted at that time. The response from the clubs was immediate and enthusiastic; in fact it amounted to a friendly rivalry as to which club should be first.

Undoubtedly this was a wise move, because since then there has, without doubt, been an increased spirit of co-operation with the Association. As sections, the clubs have proved more attractive to the higher type of chemist who in many cases has not only joined the local section, but also become affiliated with the National Association. Undoubtedly this closer relationship has increased and improved the work of the section—all of which has contributed towards building up and strengthening the organization as a whole.

Recognizing that the sections are now an important part of our Association, they have been asked to assume responsibility for the Thursday morning program of this convention. Their close contact with the practical development of the cereal chemist makes it desirable that the National Association—particularly the Annual Convention, be brought into closer contact with those vital and practical problems which the individual member in the front line trench is forced to meet in his daily work. Our conventions should be a clearing house for these problems, and each section should not only have a voice in framing the annual program, but be given every opportunity to take part in it.

This might be best accomplished if each section chairman appointed a program committee, such committee to be responsible for the presentation at each National Convention of at least one subject of interest to the section itself or the Association as a whole. They should also take part in framing the program. In order to have this proposal operate smoothly, it might be

well to insert a paragraph in the by-laws controlling the sections, setting forth rules for its performance.

The finances of the Association are in a gratifying condition. We have a comfortable surplus; a convention fund for emergencies and sufficient money collected to carry on our research fellowship for a year on a basis that will enable us to select the highest type of man and offer him sufficient remuneration to make the proposition attractive.

I desire to make two recommendations as follows:

- (1) That in carrying out the work of the Research Fellowship, now being established and financed for one year, every effort be made to complete the work in time for its final presentation at the 1931 Convention.
- (2) That the local sections be brought more prominently into the work of the National Association, and at each convention they be given a part in building the program and taking some responsibility for its presentation.

It is very gratifying to be able to say that an excellent spirit of goodwill has prevailed throughout the entire year, and I have yet to learn of a single specific case of dissatisfaction or criticism. Your officers have worked together in perfect harmony; in fact, our relations have been most pleasant. It is therefore with considerable regret that I realize the several years of delightful association with present and past officers in our labors for the organization must soon come to an end.

I want to close this address by expressing my sincere appreciation to my fellow officers, members of the various committees, and others who have cooperated so cheerfully and willingly during the past year, and in particular I desire to express my thanks to the Program and Local Arrangements Committees on whom the success of this convention so largely depends.

I wish to say that the present outlook is most encouraging and everything points to continued progress and success.

#### BOOK REVIEW

**Brotgetreide und Brot.** Lehrbuch für die Praxis der Getreideverarbeitung und Hand- und Hilfsbuch für Versuchsanstalten, Nahrungsmittel-Untersuchungssämler und Laboratorien der Mühlen, Bäckereien und Fachschulen. Dritte, neubearbeitete Auflage. By M. P. Neumann. Price R.M.33 Verlagsbuchhandlung Paul Parey, Berlin. 1929.

This is the third edition of Dr. Neumann's well known book. It is divided into seven sections as follows:

- I General botany and chemistry of the cereals.
- II Respiration and fermentation.
- III The bread cereals.
- IV Flour.
- V Bread.
- VI Baking properties and bread improvers.
- VII Bread as a nutrient. Bread supplies in Germany.

These seven sections in turn comprise 25 chapters, covering as many specific subjects.

The book has been largely rewritten throughout since the publication of the second edition in 1923. Several new plates have been added to section I, and the discussion of photosynthesis and the constitution of the carbohydrates brought up to date. Unfortunately the sources of these new facts respecting the sugars are not disclosed. Additions have been made to the treatment of starch and cellulose, and the colloidal and enzyme phenomena are discussed at greater length. Much new material has been introduced respecting cereal proteins, their properties and estimation. Acidity and H-ion concentration are likewise treated more extensively.

In Section II a notable addition concerns the production of baker's yeast. Interesting details of certain experiments involving the use of beer yeast in bread production have also been added.

Section III has been largely rewritten. Additions include the United States standards for wheat and rye, and the classification of wheat in Russia. Schindler's scheme for the classification of bread cereals in Germany has also been included. Several tabulations of composition of wheat and rye have been added. The chapter which includes details of certain analytical methods impresses the reviewers as quite inadequate, however. Thus under "moisture determination" no mention is made of the familiar and convenient distillation methods, of which the Brown-Duvel method is probably the most widely employed, nor of the recently announced electrometric methods.

Section IV deals with properties and evaluations of flour, and has undergone less change in transferring it from the preceding edition than in the instance of the other sections.

"Bread," as discussed in section V, includes a discussion of the preparation of dough. To this chapter has been added a list of several physical methods for testing dough properties and a description of the Bühler Comparator. No reference is apparently made to the Chopin extensimeter, which utilizes the same principle of testing, and appeared before the Bühler instrument. The discussion of the use of dry milk in bread has been extended, as has the use and control of acid-producing organisms in the production of rye bread. Chemical reactions involved in the use of various chemical leavening agents have been added.

Section VI is largely new material not appearing in the second edition. It includes chapters on baking quality, the influence of the individual flour constituents, various flour treatments, such as heating and spraying, bread improvers with particular reference to malt extract, phosphates, per-acid salts, bromate, etc.

In section VII bread as a nutrient is discussed. Substantial additions have likewise been made to this section.

This third edition is printed on paper much superior to that used in the second edition, which not only facilitates reading but has yielded better illustrations. Modern type has likewise been used which should be a convenience to those of us who are accustomed to its uses in printed English. As heretofore, precise citations to most of the original sources have not been included, which is unfortunate in the opinion of the reviewers. We also detect a tendency to overlook or disregard non-German sources of useful material to an extent which would lead the uninformed reader to assume that few contributions to knowledge had been made outside of Germany.

The book contains much that is useful and interesting, particularly to those who desire to become familiar with continental practices and viewpoints. It is pleasingly devoid of propaganda and gives the impression of fairness in presentation of moot subjects.

BARBARA A. BAILEY,  
CLYDE H. BAILEY.

#### MANUFACTURERS TECHNICAL PUBLICATION

**Direct Reading Humidity Recorder, Bulletin No. 880.** Illustrated bulletin describing the theory of the relative humidity recorder and giving list prices of the instrument and its accessories. 8 pp. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.